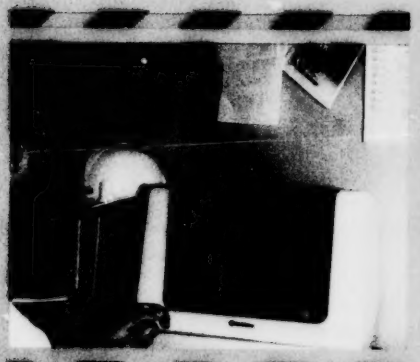
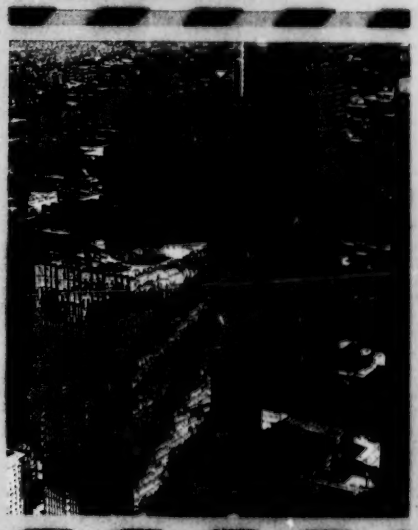
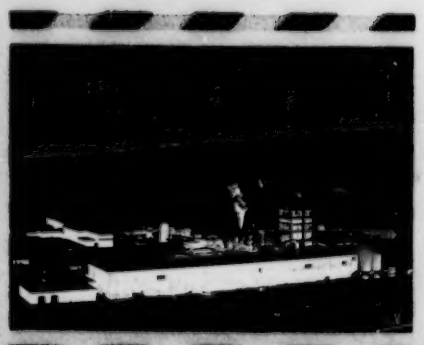
Canada Constructs

Capital Projects and Canadian Economic Growth in the Decades Ahead







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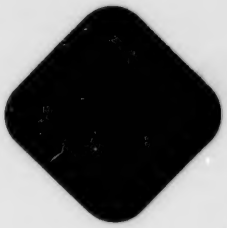

Construction Industry Development Council

Ottawa, 1984

CONSTRUCTION INDUSTRY DEVELOPMENT COUNCIL
CONSEIL POUR L'EXPANSION DE L'INDUSTRIE DE LA CONSTRUCTION

December, 1983

The Honourable Edward Lumley, P.C., M.P.,
Minister of Regional Industrial Expansion,
235 Queen Street, 11th Floor East,
Ottawa, Ontario.
K1A 0H5

Dear Mr. Lumley:

On behalf of the Construction Industry Development Council, we are pleased to present the report of a major study initiated by the Council in 1981 and carried out in the interests of the construction industry, its clients, governments and all concerned with Canada's future economic growth.

Canada's productivity and ability to compete depend largely upon its capital investment in new facilities, machinery and equipment and for modernizations. The bulk of this is designed, built and installed by the construction industry. The pace of retrofit will accelerate still more in the future. The construction industry will accordingly play a pivotal role in its clients' productivity and in Canada's overall competitive ability.

In the report the construction industry takes a hard look at itself, particularly with regard to its future capability to execute larger and more complex industrial projects. Changes in the structures and policies of governments and of their very recognition and approbation of the construction industry are also needed in order that it may perform in accordance with desired future standards. It is strongly believed that the report's recommendations merit speedy implementation by all concerned.

Yours sincerely,

P.T. Beauchemin,

Chairman

R.J. Balfour,

Task Force Chairman

235 QUEEN, OTTAWA, CANADA K1A 0H5 (613) 995-8107

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Preface

During 1980 and 1981, some sectors of the Canadian construction industry were hard-pressed to carry out efficiently the demands being made of them. Economic forecasts widely predicted larger future construction programs and — particularly in the mid-1980s — an increased number of major projects within them.

The Construction Industry Development Council (CIDC) concluded that a number of major issues facing the construction industry during the 1980s should be addressed to enhance its future capacity. These issues included both internal and external factors that would have an important bearing on the industry's ability to adjust to changing conditions and the anticipated expanded work programs.

It was decided in March 1981 to form the Task Force on the Decade Ahead. Four study groups were also appointed to deal with specific elements in the task force's study:

1. the Canadian construction program to 1990, with particular emphasis on the implications of sectoral and regional shifts within the total and the prospects of both larger programs and more "mega" projects;
2. the improvement of construction productivity, recognizing that productivity levels are affected by many factors and that productivity has often especially suffered on major projects;
3. the impact of government regulations on the initiation of construction projects, particularly with regard to the prolonged and costly delays related to land development, planning, and environmental regulations;
4. construction conditions in remote regions, recognizing that much of the future construction activity will be in the High Arctic, offshore, or in other isolated areas not suitable to the application of many provisions of government regulations and industry collective agreements.

Subsequently, the CIDC Construction Technology Committee was directed to act as a fifth study group in its area of expertise. Following the release of the report of the (Carr-Blair) *Major Projects Task Force* in mid-1981, it was decided that a sixth study group should be appointed to assess its recommendations.

The recession during 1982 and 1983 and the cancellation or deferment of many projects have granted a breathing spell — precious time in which to prepare for future challenges. In no way has the current reduced industry workload diminished the need for this study.

The recession also reinforced the desirability of there being a clearer recognition of the importance of the construction sector to a healthy economy and a better understanding of construction's role in relation to Canada's future competitive position.

Executive Summary

Employment. Competitiveness. Productivity. Inflation. Markets. Capital Investment. Technology Research and Development. All of the main concerns affecting the Canadian economy are especially manifested in the construction industry. This report deals specifically with these concerns.

The report emphasizes the urgent need for greater understanding and recognition of the vital importance of capital investment in industrial projects to maintain Canada's competitiveness and position as a leading industrial nation. This would include the infrastructure necessary to support expansion of industrialization. A greater allocation of resources to this end must be encouraged.

The report also seeks greater recognition of the construction industry's role in the realization of capital investment projects. This role includes the design work, the construction of the facilities and, to an ever-increasing extent, the design, procurement and installation of the production and process equipment contained in them. In short, the construction industry's involvement in a capital investment project often extends from R&D study activities in its conceptual phase right through to its commissioning.

The report provides objectives and guidelines in relation to conditions that are expected to prevail. It reviews the composition of the construction industry together with its major programs and suggests probable future trends. Particular attention is focused on five factors of cardinal importance to the construction industry's ability to fulfill its role — productivity, regulations, technology, work in remote regions, and "mega" projects. Inasmuch as there is an inter-association committee on construction exports, no special effort was devoted to this important subject, although several of the specific recommendations do relate to it.

Direct construction employment at the beginning of the present decade was estimated by Statistics Canada to be the annual equivalent of well over 700 000 person-years. When those employed in the manufacture, sale and transportation of construction materials and equipment were added, the total would be more than 1.5 million.

Roughly 16 per cent of Canada's gross national expenditure construction — some $55 billion annually in current dollars. Significant though this program is, it has declined in relative importance. Thirty years ago construction's share of GNE was 22 per cent.

Canada is too young and under-developed a country to reduce its capital investment program to the degree that has occurred. The deficits in the construction program have led to a serious backlog. A 25 per cent increase in construction activity would be appropriate if the country is to develop adequately its industrial potential. In so doing, the increase in construction employment and the ensuing multiplier effect on the rest of the economy would have widespread benefits.

Actions on many fronts will be required in order to achieve appreciable increases in investment in new capital assets. The construction industry will have to become more perceptive of the market needs of its clients and further advance its capabilities accordingly. This will involve more emphasis on technology and project management methodologies. The dependent improvement in clients' productivity and the price competitiveness of their products must be achieved in order to attract industrial capital investments to Canada. Similarly, improved productivity and cost-effectiveness within the construction industry are essential to encourage an upswing in capital investment decisions generally.

Governments at all levels must be more responsive to the requests of the construction industry to assist in its development, in recognition of the critical nature of its basic contribution to Canada's overall economic growth. Swift joint action by the industry and government to establish a Construction Productivity Centre would provide a focal point for activities facilitating the attainment of these goals. The educational institutions should also play an expanded role in the provision of construction-oriented courses.

Canada Constructs contains 54 specific recommendations directed at the construction industry, governments, owners, educational institutions and others involved in the construction process. In addition, it includes the following five fundamental and challenging general recommendations for the re-structuring of the construction industry and governments to create a more modern management organizational form to deal positively with the economy's needs:

1. **Industry Unity and Structure.** That the Canadian construction industry's specialized sectors, as represented by a multitude of associations and other voluntary organizations with all their strengths and complexities, must consider themselves part of an entity and work together to improve the industry's internal and external co-operation, and end product, by developing an appropriate overall management structure.

2. **Government Recognition and Structure.** That governments at all levels recognize, in their policies and structures, that the construction industry is a basic contributor to overall economic growth and improved productivity and merits strong developmental support in such areas as education and training, project management methodologies, research and development, and technology transfer (rather than regard the industry merely as the medium for the supply of their own construction requirements);

   And that senior governments set as a future goal the re-allocation and consolidation of resources to form a separate Department of Construction or its equivalent.

3. **Improved Performance and Quality of Work.** That each element and sector of the construction industry strive to improve its performance by increasing research and development on its respective technology and management methodology, and by expanding its support of and involvement in educational and training programs.

4. **Encouragement of Capital Investment.** That governments work more closely with industry to create a healthy climate for capital investment, avoiding in particular taxes on capital projects and savings; impractical environmental, planning or safety requirements; unduly onerous licensing fees or rents for resource development; and impediments to the use of new technology.

5. **Construction Industrial Relations.** That the growing number of examples of joint efforts by construction employers' and employees' organizations — designed to foster improved industrial relations, productivity, procedures for cost reduction, training and construction safety — be warmly commended and that further progressive actions of these kinds be initiated.

1 Summary and Recommendations

1.1 Summary

- **1.1.1** Introduction
- **1.1.2** Chapter 2 Definitions
- **1.1.3** Chapter 3 Construction: The Capital Projects Realization Industry
- **1.1.4** Chapter 4 Focus on Construction's Future
- **1.1.5** Chapter 5 The Canadian Construction Program, 1970-1990
- **1.1.6** Chapter 6 Construction Productivity
- **1.1.7** Chapter 7 Government Regulations
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- **1.1.9** Chapter 9 Construction in Remote Regions
- **1.1.10** Chapter 10 Report of the Major Projects Task Force

1.2 General Recommendations

1.3 Specific Recommendations

- **1.3.1** Chapter 5 The Canadian Construction Program, 1970-1990
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- **1.3.6** Chapter 10 Report of the Major Projects Task Force

1 Summary and Recommendations

1.1 Summary

1.1.1 Introduction

Construction accounts for well over half of Canada's capital investment program. Construction in 1982 is estimated to have had a value of $55 billion, or 16 per cent of Canada's gross national expenditure.

This activity gave direct employment to an average of over 650 000 Canadians and to an even greater number engaged in the supply, merchandising, and transportation of construction materials and equipment.

Moreover, the construction industry has a major involvement in the design and installation of much of the machinery and equipment that compose the balance of the capital investment program.

These are relatively little-known facts. Construction has been around since the beginning of time and is accordingly taken for granted. Most Canadians are unaware of the construction industry's changing role — its expanded responsibilities — or of its importance to the country's future competitiveness.

DOMESTIC PRODUCT SHARE OF 1982 GNP, BY INDUSTRY

Source: Statistics Canada 61-213, 61-005.

Old concepts, words, and procedures that have served well in the past no longer fit construction.

New terms, new functions, and a new understanding of the construction industry's place in the economy are needed.

For example, the construction industry now executes many projects as entities from concept to commissioning.

Developers of commercial and residential projects typically coordinate the real estate, financing, design, construction, and marketing functions. Also, industrial owners rely increasingly on EPC (engineer-procure-construct) firms to be responsible for not only the construction phase but also the process or production capital equipment aspect of their projects.

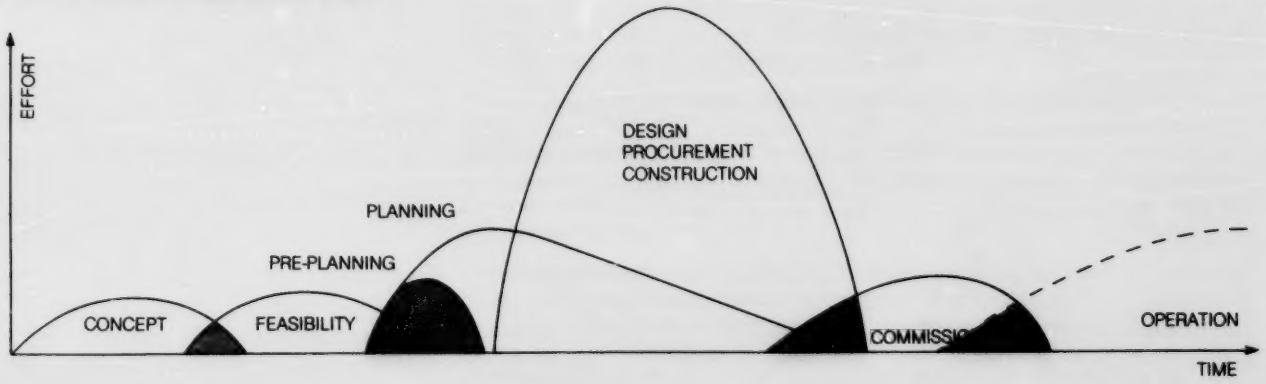
Similarly, there has been a trend towards the adoption of overall project management procedures in the institutional, energy, and public works categories.

Accordingly, the construction industry today (and increasingly so in the future) would more appropriately be described as the *Capital Projects Realization Industry*.

This expanding responsibility of the construction industry — already Canada's largest industry — bears with it heavy challenges and problems as well as opportunities.

For example, the levels of construction costs and of construction technology affect the competitive capability of all other industries. Canada's future productivity will be directly linked to its capital investment programs for more efficient production facilities and infrastructure.

TYPICAL PHASES OF A PROJECT LIFE CYCLE, CAPITAL PROJECTS REALIZATION INDUSTRY



1.1.2 Chapter 2 Definitions

It is important that the overall involvement of the construction industry in the realization of capital projects be fully recognized. "Construction" is not just a matter of on-site activities of installing materials, components, and capital equipment or of changing the landscape. It also includes conceptual, research, development, exploration, design, manufacturing, supply, testing, and many other activities forming part of the construction process.

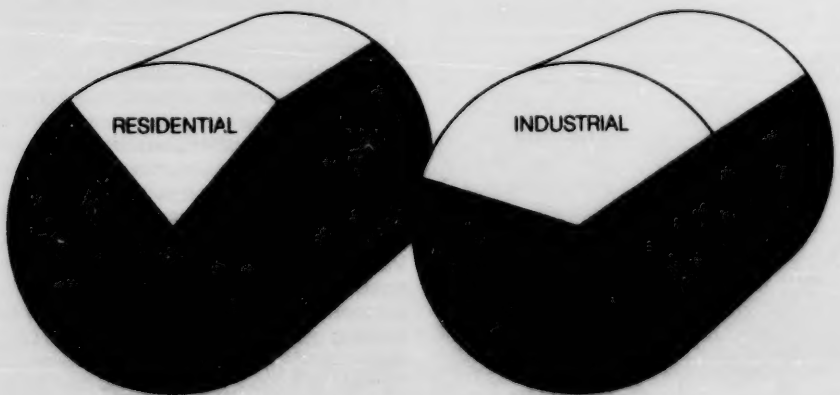
Traditionally, construction has been termed a "service" industry and its program broken down into "residential" and "non-residential" categories.

Such descriptions are dangerous in their shortcomings.

True, the industry provides construction services to its clients, but it is basically a "production" industry. Unlike other "service industries", it produces goods — a vast array of new capital assets, ranging from a modest dwelling to a mammoth energy project.

The provision of housing responds to the basic need for shelter and therefore directly affects all Canadians. Residential construction is accordingly a most important part of the construction program.

1982 CONSTRUCTION PROGRAM BREAKDOWN



To describe all of the rest as merely "non-residential", however, is to sell exceedingly short the vital components of 75 per cent or more of the total construction program!

A more useful division of the construction program into two major classifications is that of *Industrial Projects* and *Infrastructure Projects*. Broadly speaking, it is by means of capital investment in industrial projects and the resulting production of goods (including energy) that our economy can grow and be competitive in world markets. The transportation, housing, communications, commercial, educational, energy distribution, and other projects included in the infrastructure category are provided basically to support industrial activities.

In the long run, infrastructure projects can be financed only if the industrial base of the Canadian economy is expanding. Particular attention should therefore be given to the encouragement of viable industrial projects. In this respect, the construction industry — the capital projects realization industry — is deeply involved in the creation of new facilities and increasingly in their process equipment and future working environment.

1.1.3 Chapter 3 Construction: The Capital Projects Realization Industry

"As construction goes, so goes the nation." When the industry's capacity is in a growth mode, there is tangible evidence that the economy is healthy. And vice versa.

During World War II and in most of the postwar period, the construction industry grew substantially in overall size and in its capacity to execute increasingly large and complex projects at home and abroad.

For example, custom house building gave way to project housing, multi-unit structures, and the development of entire communities. Canada has had its full share of mega projects over the years, but their numbers and diversity increased. The overall volume of construction projects of all sizes also grew, and the geographic location of projects expanded dramatically.

During this period, the structure of the construction industry underwent numerous changes in response to the larger workloads. The pursuit of excellence was marked by more and more specialization on the one hand and the development of project management skills to coordinate all of the specialists on the other.

The construction industry has traditionally had easy entry and upward mobility and has provided widespread scope for individual enterprise, innovation, and growth. The great majority of the industry's member firms are local or regional in their operations and are "Small Business", with personal, full-time participation by their owners. In some construction industry sectors, the development of large nationwide or interprovincial organizations has also proven to be effective.

A fair number of such organizations are foreign owned or controlled. In general, however, the Canadian construction industry is Canadian owned, and its projects have a high overall Canadian content. Moreover, there is a favourable

balance of trade for the construction industry in the order of $1 billion a year.

Thirty years ago, construction's share of Canada's gross national expenditure (GNE) had risen to 19.3 per cent. The ten-year average from 1952 to 1961 was 20 per cent, peaking in 1957 at 22 per cent. The average for the years following 1961 declined to 17 per cent, and construction's share of GNE is now at its lowest level since 1947.

1.1.4 Chapter 4
Focus on Construction's Future

As a country matures industrially, it is normal for it to devote a smaller proportion of its GNE to construction; the bulk of its production facilities and infrastructure has already been built. This factor, however, should not be a basis for accepting the decline of construction's share of Canada's GNE to 16 per cent.

Although Canada is one of the world's leading industrialized countries, it has a complete span of all levels of economic development.

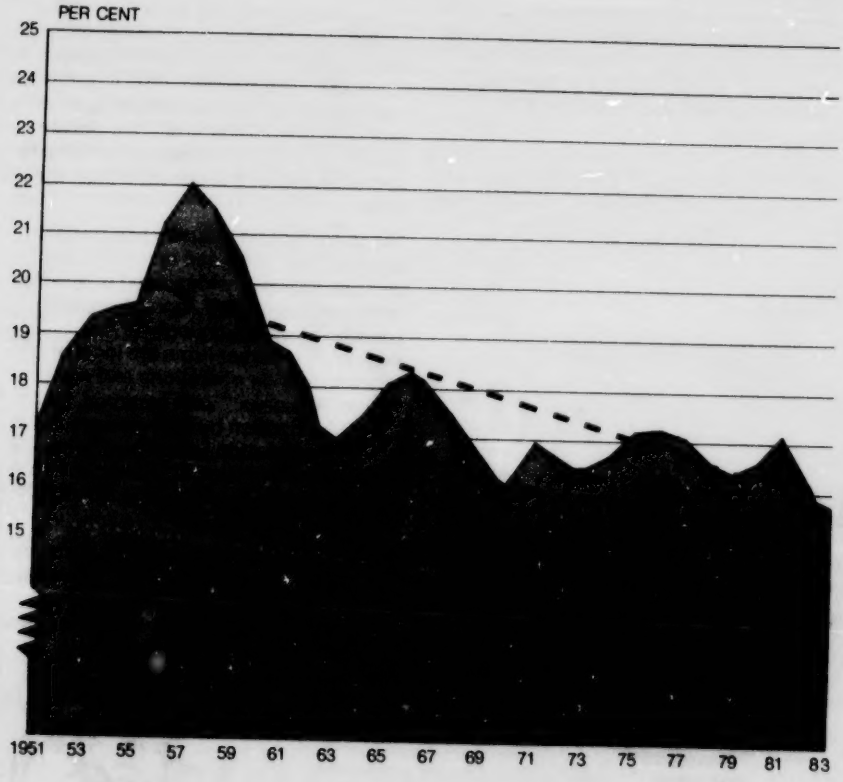
Relatively small sections of the total land mass in the southern portions of Quebec and Ontario and in the lower British Columbia mainland are in an advanced state of industrial development and are showing some signs of post-industrial stress.

The balance of the southern portion of the country could be described as still "developing" or as "lesser developed" regions. The southern interior regions of the Western provinces, for example, have great potential for continued and rapid growth. The stimulus of offshore resource development could have a similar effect on the Atlantic provinces.

The areas farther north in the Canadian Shield, the Mackenzie Valley, and adjacent western regions are now "sub-lesser developed", although on the brink of substantial resource exploration and development. The High Arctic is one of the few regions whose development potential is relatively unknown.

The above analysis demonstrates that Canada as a whole is largely a "developing nation". Accordingly, the current 16 per cent share is too low, and the restoration of a share of GNE of 20 per cent or more for construction activity could again be appropriate if the country is to develop further industrially.

CONSTRUCTION IS DECLINING AS A SHARE OF GROSS NATIONAL EXPENDITURE

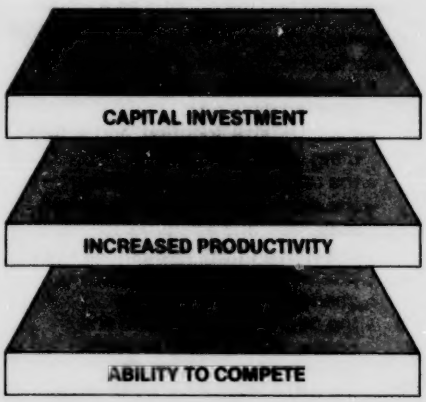


The 1982-1983 recession has contributed greatly to the recent general decrease in capital investment by Canadian industry. Productivity improvements of the future and the ability to compete internationally will depend largely on capital investment projects for both new or modernized facilities today and in the next few years.

The role of the construction industry in the realization of these capital investment projects is fundamental to Canada's economic progress or even survival as a leading industrial nation.

The industry's structure will continue to evolve to better meet the needs for more efficient, cost-effective production facilities and supporting infrastructure. Possible developments to this end include the continued concentration of exploration and development expertise for mineral, oil, and gas projects; a closer link between capital equipment manufacturers and advanced process technology purveyors; consortia or other affiliations between large consulting engineering firms and large general contractors; more vertical integration; increased specialization on the part of contractors; greater emphasis on project management methodology and training generally; and a combination of more off-site fabrication and the development of a more highly skilled on-site labour force.

FLOW CHART



The structure of governments will similarly need to change to give the necessary recognition and support to the capital projects realization industry.

All levels of government in Canada have traditionally been structured merely to accommodate their own needs for construction infrastructure. Departments of public works, highways, housing, government services, etc., have been mandated to administer contracts, build or maintain municipal services, institutional buildings, transportation facilities, public housing, defence installations, or other public works projects.

Valuable assistance has been given specifically to the construction industry in the areas of education, training, and research. *However, there is no general recognition in government structures in Canada that construction is a basic contributor to overall economic growth and merits strong developmental support.* Indeed, construction is often excluded from such support programs. There is no department equivalent to those that have long operated to help promote the growth and welfare of agriculture, forestry, mining, or fishing and, more recently, communications — yet construction is far more important in terms of GNP share and employment than any of the above industries.

Moreover, a healthy construction industry is most important to such other industries because construction's efficiency has a direct effect on their own efficiency.

1.1.5 Chapter 5 The Canadian Construction Program, 1970-1990

The annual physical volume of construction increased by about 35 per cent during the 1970s. Most of this gain occurred in 1971, 1973, and 1976. Within the total, there were significant shifts, both in geographic and sectoral distribution. Western Canada's share rose from one-third to one-half; Alberta and Saskatchewan experienced large gains, particularly at the expense of Ontario.

The relative importance of housing in the Canadian construction program fell from a peak of 37 per cent in 1977 to below 30 per cent during the balance of the decade. The share of institutional building construction also declined. The overall importance of engineering construction rose, with significant gains for gas and oil facilities and reductions for roads and airport runways.

Modest increases in the volume of construction occurred in 1980 and 1981, but in 1982 the volume of industrial projects and infrastructure projects declined 6 per cent and 12 per cent, respectively. A further general reduction in physical volume is expected to take place in 1983.

Demographic factors indicate that the Canadian population will grow at a rate of less than 1 per cent per year for the balance of the century. This is less than half the rate of increase experienced between 1950 and 1975. Residential construction and certain other types of infrastructure projects, such as schools, are projected to show a corresponding decline in the volume of new construction, which is offset to some degree by increased repair, renovation, or retrofit work.

Econometric projections for industrial projects show strengthening in the latter half of the decade. They indicate that the physical volume of 1981 will be regained by around 1985 and will continue to grow for the balance of the decade. Two premises of this projection are that a further series of major electric power projects will then be viable and, more important, that improved world economic conditions will help to stimulate resource development and manufacturing expansion.

Forecasting can be perilous. The experience of the past two years has shown dramatically how widely accepted assumptions can fail to materialize. If the present econometric projections come to pass or are exceeded, the construction industry will have to gear up again for larger overall programs and for a larger number of major or mega projects within them. If the projections are not realized, Canada's future competitiveness will be in further jeopardy.

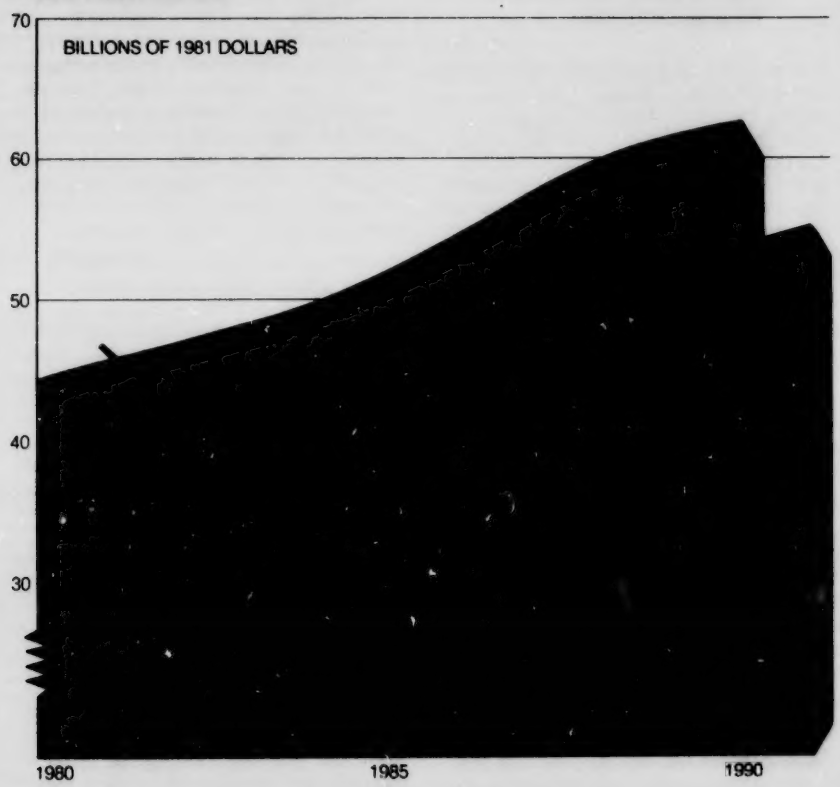
Either way, the construction industry will be called upon to improve its performance. In a rising market, the industry must meet the challenge of executing larger programs and projects efficiently. In a declining market, it must also increase its efficiency to help stimulate capital investment.

Two years ago, there were serious shortages of certain skills. The recession has led to a serious loss in the industry's human resources at all levels to other industries and to other countries. It is in the national interest to have construction volumes that will prevent further erosion of the construction industry's vital resources.

One safe prediction is that there will again be serious shortages as construction activity attains previous levels. It is therefore vital that training and retraining programs be launched during the present breathing spell to meet future needs. Programs should include not only skilled tradesmen but also project management, design, and supervisory personnel.

A significant portion of the program carried out by members of the Canadian construction industry is in the export market. For example, 20 per cent of the billings of consulting engineers are related to foreign projects. A major share of the operations of Canadian developers is located in the United States market. Manufacturers of certain construction materials, capital equipment, prefabricated components and structures, etc., are active in export trade. A number of contractors, architects, and other members of the industry also work in other countries.

1981 AND 1983 PROJECTIONS, NEW CONSTRUCTION



Industry conditions in Canada will likely have the positive effect of increasing the effort made by members of the construction industry to secure foreign contracts. International competition will become more intense. The desire of many foreign owners to award turnkey contracts for their projects will require the grouping of Canadian design professionals, manufacturers, and contractors to submit combined proposals. Similarly, a shift to industrial projects from infrastructure projects on overseas work will necessitate greater emphasis on leading-edge process technology. It will be essential that the arrangements for financing and risk insurance available to Canadian enterprises be competitive with those available to members of the construction industry of other nations.

1.1.6 Chapter 6 Construction Productivity

In the construction industry, "productivity" is normally defined as being closely akin to "efficiency" or "cost effectiveness". Increasing productivity in the construction industry is a compelling, ongoing goal. The stakes are high. A reduction of a few per cent in productivity on a major project means many millions of dollars in extra costs. A reduction applied to projects in general could cost well over a *billion* dollars a year. Conversely, the improvement of construction productivity will mean matching savings or will at least work to offset inflationary trends. These factors are important throughout the entire life cycle of a project and affect the competitive edge of the individual firms concerned and the country as a whole.

Construction productivity is affected by many factors, including the following:

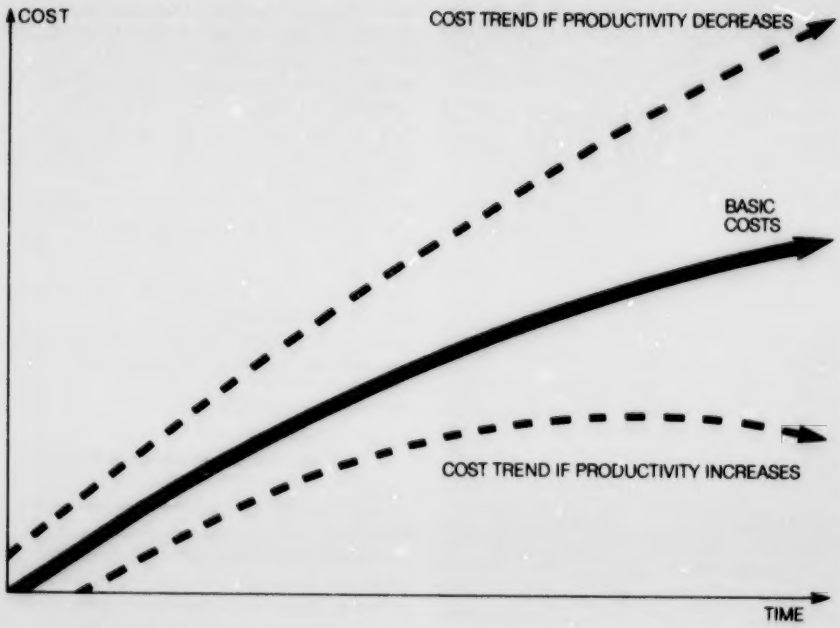
- the calibre of the design and working drawings;
- the type, size, location, and scheduling of the project;
- the contractor's organization;
- the availability of suitable labour, materials, and equipment;
- the speed of the decision-making process regarding permits, changes, and extras;
- the degree of motivation and cooperation among project personnel;
- the advancement of technology;
- the level of safety.

Construction practitioners and owners commonly hold strong opinions about the principal factors that improve or impair construction productivity. These opinions, however, often vary widely. A CIDC survey was conducted among 200 knowledgeable owners, designers, contractors, developers, labour union officials, etc., to see whether a consensus on the subject could be obtained. Participants were asked to rank the most important factors impairing construction productivity from a total of ninety-five listed under seven categories and then to rank the seven categories in order of importance.

The responses in the completed questionnaires were representative of the different regions of the country, sectors of the industry, and sizes of project. The replies included a good many from senior officers of major organizations representing a large volume of work. In summary, they provided a significant sampling of opinion. Special concerns and built-in biases may explain why the selections of one group were not shared by others. The common identification of many factors, however, indicates that there are good potential areas for follow-up work. The survey also confirmed widespread interest in improving construction productivity as a means of reducing costs and helping to generate new capital projects.

An analysis of the opinions of general contractors, trade contractors, owners, and union officials showed that each group placed management of the construction phase, project conditions, and

PRODUCTIVITY AND COSTS



design and procurement among the top four major categories of factors impairing construction productivity. The first three groups of respondents also included labour in this selection. With regard to specific factors that impaired construction productivity, the general and trade contractors were quite similar in their choices, which were noticeably in the labour category. The owners and union officials, on the other hand, made similar selections, which were mainly in the design and the construction categories. All except the labour group rated restrictive union rules as a principal factor; in many cases, the examples given were collective agreement provisions agreed to by employers.

The CIDC is committed to expanding its truly preliminary productivity study. However, a substantive improvement of construction productivity will require widespread and ongoing efforts by all groups involved in the construction process. The establishment of a Centre for Construction Productivity, sponsored by industry and government, would provide a focal point for such activities and the dissemination of related information.

1.1.7 Chapter 7 Government Regulations

The construction industry has both general and specific interests in regulatory reform.

First, its members' operations are subjected to myriad regulations administered by all levels of government — perhaps more than any other industry.

Second, the uncertainties, delays, and costs of unduly onerous regulations place many capital projects in jeopardy and have an adverse effect on economic growth without commensurate benefits. Examples include environmental regulations and regulations on the development of urban land.

The excessive burden of regulations is so well documented that many governments have adopted programs for regulatory reform. However, such programs are commonly behind schedule and obviously require a higher priority. Regulatory reform is an element of good government and should be lodged with the minister or councillor who has the government management portfolio or is at least close to the first minister's or mayor's office. New regulations should be discussed while in draft form with interested parties; have benefits that clearly outweigh *total* costs; and be subject to sunset provisions.

The protection and preservation of the environment are objectives that are strongly supported by the construction industry. The application of environmental regulations, however, all too often has resulted in unjustified expenditures and lengthy delays that affect the economic viability of capital projects. The main complaints are related to an impracticable zero-risk philosophy, double standards, uncertainties, overlapping jurisdictions, and conflicting requirements.

In consultation with interested parties, regulatory authorities should establish environmental objectives that are appropriate for specific regions. Also, guidelines and procedures should be published with a view to reducing the time lost and the expenses now experienced by project sponsors.

Regulations on land development and planning are also the subject of widespread complaint because of the time and cost involved in obtaining permission to develop land. These extra costs have to be borne by the ultimate user. Once again, the regulations should be subject to realistic cost/benefit analysis.

In addition, it is most important that new provisions of construction materials standards and of building codes be subjected to careful cost/benefit analysis — just like any other regulation. Similarly, the various jurisdictions should adopt uniform building codes based on the latest edition of the National Building Code of Canada and ensure that there is provision for the consideration of innovative materials, usages, or techniques.

1.1.8 Chapter 8 Construction Technology

Construction is technology intensive and increasingly a high-tech industry. New developments typically pose new challenges that require technical solutions. The increased size and diversity of construction projects and programs have greatly increased the industry's knowledge base and the level of technical knowledge required of its personnel.

These trends will continue. Moreover, the ability to compete will depend increasingly upon technological advancement. An industry's technology is obtained through its educational and training programs; its systems for information transfer; its opportunities to gain practical experience and introduce innovations; and research and development activities.

More attention will have to be devoted to all of these factors in order that the Canadian construction industry retain and improve its competitive edge. Achieving a substantially higher absorption of available technology is a basic need.

A number of universities and community colleges offer specialized courses in construction engineering, construction management, supervisory skills, building science, etc., and have been catalogued by the Canadian Construction Management Development Institute. More courses are needed. However, industry must show greater interest and involvement in these initiatives to ensure their continuation and relevance to industry needs. Computer training is now well integrated in the educational system, but many construction managers and senior personnel need training in the use of appropriate computer systems and techniques.

As in most countries, most of the research, development, and demonstration (RD&D) activity in construction in Canada is conducted by governments, integrated utilities or companies in the energy field, and manufacturers. Over the years, the federal government has been the main funder of construction RD&D, but its outlays for the construction sector are far less than those for smaller industries, such as agriculture, forestry, fishing, and mining. Governments should give greater recognition to the importance of the construction industry in their own RD&D programs and in policies designed to encourage companies and associations to establish or expand such activities. A comparison with other western industrialized countries indicates that total annual outlays for construction R&D in Canada should be at least 0.2 per cent of the value of the construction program.

1.1.9 Chapter 9 Construction in Remote Regions

A large portion of Canada's reserves of minerals and hydrocarbons are located in remote regions of the country and offshore. Typically the climate is unfriendly, the environment is fragile, the population base is small, and the infrastructure is minimal. The related construction projects may well be of major dimensions and their logistics correspondingly exceedingly demanding.

Under such circumstances, provisions in government regulations and collective agreements established for the more populated areas of the country may be unsuitable. Traditional native pursuits and policies for environmental preservation and land use may well conflict with the proposals of project sponsors.

The pace and scale of resource development in the High Arctic and other remote regions of Canada are uncertain during present world economic conditions. In due course, however, the volume of oil, natural gas, mining, and hydroelectric power projects and related infrastructure will increase. A CIDC survey was conducted among northern residents and contractors, union officials, owners, utilities, and public servants experienced in northern construction projects to solicit their views on how such projects should best be handled. The questionnaire had separate sections on the market place, legislation

and regulations, logistics and weather conditions, and labour agreements and working conditions.

The respondents favoured positive thinking by governments about northern development. This thinking would include the establishment of a clear and comprehensive policy with stated objectives to assist peoples in remote areas, to upgrade public services, and to establish a uniform approach in the development of resource industries and related infrastructure. A concerted effort should be made to encourage native participation in such projects.

The provision of tax incentives designed to encourage individuals and corporations to work in remote regions was widely advocated as a means of stimulating northern development and attracting a skilled work force. Employment standards and conditions should be tailored to northern requirements. However, in the interests of safety and efficiency, apprenticeship in the indentured trades and skill standards should not be reduced.

A balanced and coordinated approach to environmental protection that would serve both the need for the development of economic resources and the protection of the environment was urged. The requirements of a comprehensive cost/benefit environmental impact study should be developed as early as possible for each major project.

The consensus was that labour agreements should not be imposed on northern developments but should be negotiated by employers and unions. Basic conditions appropriate for labour agreements in remote regions should be established by legislation. The concept of equal rates of pay for transient and local workers was supported, but travel and living allowances for transients should be accepted. The concept of composite crews, particularly for small or medium-sized projects, was widely supported.

The above viewpoints are endorsed by the CIDC.

1.1.10 Chapter 10 Report of the Major Projects Task Force

The (Carr-Blair) *Major Projects Task Force Report*, published in mid-1981, was the culmination of a detailed study by senior representatives of owners, business, and labour. The report contained an inventory of major projects and a series of recommendations directed at gaining maximum benefits for Canadians from their execution. The implications of a number of these recommendations and of their implementation are of critical importance to the construction industry.

The inventory of major projects contained in the report was a first attempt. Regrettably, the inventory total was inflated by including a number of individual developments more than once. Moreover, projects were not rated according to their probability of occurrence. Consequently, many readers may have obtained a misleading impression of the number of major projects that would be built. The maintenance of an up-to-date inventory of major projects is most desirable, but it should be prepared by an independent body that can ensure confidentiality and assess the probability of proposed projects going ahead.

The Major Projects Task Force's recommendations, however, were made quite independently of its inventory, and many of them are strongly supported. Fourteen of the total of fifty-one were assessed as deserving priority attention in implementation. These recommendations included the establishment of a Major Projects Assessment Agency; maximum access for Canadians and for Canadian firms to major projects being built in Canada; the elimination of duplication of regulations and unnecessary delays in the commencement of projects due to regulatory processes; the standardization of provincial certification and licensing of manpower and its coordination on a national basis; the elimination of barriers to manpower mobility; the encouragement of the development and use of Canadian technology; the establishment of clearly defined procurement policies; and the maximum use of Canadian standards.

On the other hand, it was concluded that under current conditions, nine of the Major Projects Task Force's recommendations warrant revision. Moreover, six areas of concern that merit further study were identified, including a list of research topics related to the execution of major projects, with special emphasis on the development of the manage-engineer-procure-construct (MEPC) sector of the industry.

1.2 General Recommendations

The study groups have developed over fifty specific recommendations directed at governments, the construction industry, owners, educational institutions, and others involved in the construction process. These recommendations are contained in chapters five to ten and are also listed at the end of this chapter for ready reference.

It is urged that an immediate start be made on implementing the recommendations and that an annual progress report be made by those identified in them.

In addition, after reviewing the specific recommendations, the Council formulated the following general recommendations.

1. Industry Unity and Structure That the Canadian construction industry's specialized sectors, as represented by a multitude of associations and other voluntary organizations with all their strengths and complexities, must consider themselves part of an entity and work together to improve the industry's internal and external co-operation, and end product, by developing an appropriate overall management structure.

2. Government Recognition and Structure That governments at all levels recognize in their policies and structures that the construction industry is a basic contributor to overall economic growth and improved productivity and merits strong developmental support in such areas as education and training, project management methodologies, research and development, and technology transfer, rather than regard the industry merely as the medium for the supply of their own construction requirements; and that senior governments set as a future goal the reallocation and consolidation of resources to form a separate Department of Construction or its equivalent.

3. Improved Performance and Quality of Work That each element and sector of the construction industry strive to improve its performance by increasing research and development on its respective technology and management methodology and by expanding its support of and involvement in educational and training programs.

4. Encouragement of Capital Investment That governments work more closely with industry to create a healthy climate for capital investment, avoiding in particular taxes on capital projects and savings; impractical environmental, planning, or safety requirements; unduly onerous licensing fees or rents for resource development; and impediments to the use of new technology.

5. Construction Industrial Relations That the growing number of examples of joint efforts by construction employers' and employees' organizations designed to foster improved industrial relations, productivity, procedures for cost reduction, training, and construction safety be warmly commended and that further progressive actions of these kinds be initiated.

Matrix Relationship between General and Specific Recommendations

1. INDUSTRY UNITY AND STRUCTURE	2. GOVERNMENT RECOGNITION AND STRUCTURE	3. IMPROVED PERFORMANCE AND QUALITY OF WORK	4. ENCOURAGEMENT OF CAPITAL INVESTMENT	5. CONSTRUCTION INDUSTRIAL RELATIONS
	5.2 Improve Usefulness of Statistics	5.1 Systems Approach for Statistical Coverage		
6.2 Productivity Data Collection	6.1 Construction Productivity Centre	6.4 Productivity Improvement Programs	6.1 Construction Productivity Centre	6.1 Construction Productivity Centre
	6.3 Construction Productivity Indexes	6.6 Project Management Training	6.4 Productivity Improvement Programs	6.5 Productivity Improvement Programs
7.2 Regulatory Reform Promotion	7.1 Regulatory Reform	7.2 Regulatory Reform Promotion	7.3 Excessive Regulation Relief	
	7.3 Excessive Regulation Relief	7.9 Uniform Building Codes	7.4 Environmental Regulation Cost/Benefit Analysis	
	7.4 Environmental Regulation Cost/Benefit Analysis		7.5 Regulation Management Economies	
	7.5 Regulation Management Economies		7.7 Land Development Regulation Cost/Benefit Analysis	
	7.6 Combined Hearings		7.8 Standards and Codes Cost Criteria	
	7.7 Land Development Regulation Cost/Benefit Analysis			
	7.8 Standards and Codes Cost Criteria			
	7.9 Uniform Building Codes			
8.1 Off-Site Fabrication	8.2 R&D Encouragement	8.1 Off-Site Fabrication	8.1 Off-Site Fabrication	8.1 Off-Site Fabrication
8.2 R&D Encouragement	8.3 Assistance to Educational Institutions	8.2 R&D Encouragement	8.7 Open Technology Transfer	8.4 National Training Standards
8.3 Assistance to Educational Institutions		8.3 Assistance to Educational Institutions		
8.5 Computer Software Systems	8.5 Computer Software Systems	8.5 Computer Software Systems		
8.8 Task Force on R&D Activities	8.6 Industry Participation in RD&D Programs and Evaluation of Results	8.6 Industry Participation in RD&D Programs and Evaluation of Results		
8.11 Construction Technology Interface				
	8.8 Task Force on R&D Activities	8.7 Open Technology Transfer		
8.12 Construction Management Institute	8.10 Construction R&D Support	8.8 Task Force on R&D Activities		

1. INDUSTRY UNITY AND STRUCTURE	2. GOVERNMENT RECOGNITION AND STRUCTURE	3. IMPROVED PERFORMANCE AND QUALITY OF WORK	4. ENCOURAGEMENT OF CAPITAL INVESTMENT	5. CONSTRUCTION INDUSTRIAL RELATIONS
8.14 Construction Technology Export Strategy	8.12 Construction Management Institute	8.9 In-House Research		
	8.13 Construction Technology Transfer	8.11 Construction Technology Interface		
		8.12 Construction Management Institute		
	8.14 Construction Technology Export Strategy			
9.3 Native Training Programs	9.1 Clarified Northern Development Policies	9.4 Northern Tax Allowances	9.1 Clarified Northern Development Policies	9.3 Native Training Programs
9.7 Early Cost-Benefit Impact Studies	9.2 Uniform Government Approval Procedure for Resource Development	9.12 Pragmatic Employment Incentives	9.2 Uniform Government Approval Procedure for Resource Development	9.4 Northern Tax Allowances
9.8 Remote Region Resource Development	9.3 Native Training Programs	9.13 Cold Weather Construction R&D Centre	9.5 Northern Tax Incentives	9.5 Northern Tax Incentives
	9.4 Northern Tax Allowances		9.7 Balanced Environmental and Developmental Requirements	9.6 Northern Employment Requirements
	9.5 Northern Tax Incentives			
	9.6 Northern Employment Requirements		9.8 Remote Region Resource Development	9.10 Negotiated Northern Labour Agreements
	9.7 Balanced Environmental and Developmental Requirements			9.11 Equitable Pay and Allowances
	9.8 Remote Region Resource Development			9.12 Pragmatic Employment Incentives
	9.9 Development Policy Guidelines			
	9.10 Basic Labour Standards			
	9.12 Pragmatic Employment Incentives			
	9.13 Cold Weather Construction R&D Centre			
10.1 Major Projects Information Analysis	10.1 Major Projects Information Analysis	10.2 MPTF Priority Recommendations	10.1 Major Projects Information Analysis	10.2 MPTF Priority Recommendations
10.6 Canadian Standards in World Markets	10.2 MPTF Priority Recommendations	10.3 External Technology Permitted	10.2 MPTF Priority Recommendations	10.7 Productivity Research Initiatives

1. INDUSTRY UNITY AND STRUCTURE	2. GOVERNMENT RECOGNITION AND STRUCTURE	3. IMPROVED PERFORMANCE AND QUALITY OF WORK	4. ENCOURAGEMENT OF CAPITAL INVESTMENT	5. CONSTRUCTION INDUSTRIAL RELATIONS
10.7 Productivity Research Initiatives	10.3 External Technology Permitted	10.7 Productivity Research Initiatives	10.3 External Technology Permitted	
10.10 MEPC Sector Development	10.4 Competitive Export Support Programs	10.10 MEPC Sector Development	10.7 Productivity Research Initiatives	
	10.5 Preferential Premiums Negotiable		10.8 Major Project Benefits Optimization	
	10.6 Canadian Standards Study		10.9 Canadianization Cost/Benefit Study	
	10.7 Productivity Research Initiatives		10.10 MEPC Sector Development	
	10.8 Major Project Benefit Optimization			
	10.9 Canadianization Cost/Benefit Study			
	10.10 MEPC Sector Development			

1.3 Specific Recommendations

1.3.1 Chapter 5 The Canadian Construction Program, 1970-1990

Recommendation 5.1 That a systems approach be adopted in the collection and publication of statistics on capital investment realizations and intentions and on the construction industry generally, including the following features.

a) The Standard Industrial Classification (SIC) should reflect the principal distinctive categories of activity in the construction industry and be adhered to in statistical series relating to volume, employment, prices, costs, etc.

b) The initial division into categories of construction projects should be that of industrial projects and infrastructure projects.

c) The statistical breakdown or coverage of construction activity should relate to current systems under which the industry operates.

See section 5.5.4.

Recommendation 5.2 That the Government of Canada, through its own statistical agencies and through support to those developing projections of future construction activity, achieve, in consultation with users, further improvements in the coverage, accuracy, and usefulness of construction statistics.

See section 5.5.4.

1.3.2. Chapter 6 Construction Productivity

Recommendation 6.1 That a Centre for Construction Productivity be established, sponsored by industry and government, as a focal point in Canada for the collection and development of data, the identification of opportunities for improved productivity, the initiation of studies, and the dissemination of related information.

See section 6.4.1.

Recommendation 6.2 That productivity data be collected by owners and contractors (or their associations) on a standard basis for selected construction tasks so that comparisons may be made over time, between regions, and with different variables.

See section 6.4.2.

Recommendation 6.3 That Statistics Canada be requested to develop, in consultation with the construction sector, indexes of construction productivity of a current nature for the main subsectors.

See section 6.4.2.

Recommendation 6.4 That construction industry associations give greater attention in their programs to improving construction productivity through workshops, seminars, training courses, and special studies.

See section 6.4.3.

Recommendation 6.5 That the organizations representing construction employers and employees engage in joint efforts to improve productivity in recognition that this goal is in their mutual, job-creating interest.

See section 6.4.3.

Recommendation 6.6 That universities, community colleges, and other educational institutions expand their curricula for courses on project management, construction management, supervisory training (for example, foremen), and apprenticeship and trade training in consultation with the construction sector and the Canadian Construction Management Development Institute, so as to better meet the industry's needs; and that adequate funding be committed to ensure that such courses be offered on a continuing basis.

See section 6.4.4.

1.3.3 Chapter 7 Government Regulations

Recommendation 7.1 That regulatory reform be accorded high priority by the leaders of all governments in Canada; that responsibility for the execution of programs in this area be assigned to a senior cabinet or council member; and that periodic progress reports be required.

See section 7.2.

Recommendation 7.2 That members of the private sector assist in the advocacy and implementation of regulatory reform and identify regulations that cause unnecessary delays and outlays.

See section 7.2.

Recommendation 7.3 That economic recovery be stimulated by the speedy revision of unduly onerous regulations that impede the start of desirable projects; and that, as a general procedure, each regulation should automatically expire after a specified period of from two to five years, unless its continuance is justified by an independent body's regular evaluation.

See section 7.2.

Recommendation 7.4 That cost/ benefit analysis be an integral part of the development of blanket regulations on environmental control.

See section 7.3.1.

Recommendation 7.5 That regulatory authorities establish, in consultation with interested parties, environmental objectives appropriate for specific regions and conditions, guidelines, and procedures, with the object of reducing the time and expense now incurred by project sponsors and their agents.

See section 7.3.1.

Recommendation 7.6 That a review be made by the various levels of government of their environmental regulations to determine conflicts, overlaps, and obsolescence and to explore the scope for combined jurisdictional hearings.

See section 7.3.1.

Recommendation 7.7 That a realistic assessment be made of each existing and proposed regulation on land development and planning to ensure that its overall benefits justify the costs; and that there be periodic reevaluations.

See section 7.3.2.

Recommendation 7.8 That all committees that develop or revise mandatory standards and codes in the construction sector include in their deliberations economic and social criteria along with those of a technical, safety, and legal nature; and that consideration be given as a standard procedure to the effect of proposed requirements on the costs of design, approval procedures, materials, construction, supervision, and operation.

See section 7.3.3.

Recommendation 7.9 That the provincial and territorial governments adopt uniform building standards (codes), based on the latest edition of the National Building Code of Canada, for their respective jurisdictions.

See section 7.3.3.

1.3.4 Chapter 8 Construction Technology

Recommendation 8.1 That the construction industry, including its suppliers of materials, plant, and equipment, encourage new techniques of offsite fabrication of structures, plant, and equipment and their components to improve productivity, with particular emphasis on remote sites and large industrial projects.

See section 8.2.1.

Recommendation 8.2 That the construction industry and governments continue to support and encourage research leading to the reduction of the cost impact of regulations, the optimal conservation of energy in buildings, and improved safety conditions.

See section 8.2.3.

Recommendation 8.3 That the industry and governments demonstrate greater interest in the initiatives taken by educational institutions to develop courses to meet the special needs of the construction industry by providing practical advice on curricula, assistance in the funding of courses and awards, and opportunities for employment.

See section 8.2.4.

Recommendation 8.4 That construction industry management and labour formulate plans with educational and training institutions to produce — with government assistance — training courses to a nationwide standard for construction supervisors and craftsmen, as already established in several trades under the "Red Seal" program.

See section 8.2.4.

Recommendation 8.5 That extraordinary efforts be made by the construction industry, government, and teaching institutions to establish a national capacity to develop and use appropriate computer software for application to design, management information systems, and the operation of buildings and industrial plants.

See section 8.2.7.

Recommendation 8.6 That there be more industry participation in decisions within federal and provincial governments in establishing priorities for expenditures for development and demonstration programs and in the application of a modern systems approach to the evaluation of performance and results.

See section 8.2.8.

Recommendation 8.7 That better recognition be given to the value of open technology transfer within, to, and from Canada in increasing Canadian productivity and international competitiveness.

See section 8.2.8.

Recommendation 8.8 That the federal government, with a cross-section of industry representatives having high-technology, management, and marketing skills, form a task force to examine industry initiatives to stimulate the development of technology in concert with government programs and research activities.

See section 8.2.8.

Recommendation 8.9 That the construction industry be encouraged, through its associations or individual firms, to establish or expand in-house research activities; and that those associations with industry development funds devote part of the proceeds to research, development, and demonstration activities.

See section 8.3.1.

Recommendation 8.10 That governments recognize the importance of construction R&D; ensure that their research budgets keep pace with the ongoing needs of the industry (that is, the overall total is not less than 0.2 per cent of construction volume); ensure, through appropriate consultation, that this research is relevant to the needs of industry; and develop or expand joint programs with industry to encourage research in the private sector.

See section 8.3.2.

Recommendation 8.11 That a concentrated effort be made by all sectors of construction industry to increase their interface with one another on technical matters and that a special conference be convened for major associations and senior officials of government to develop appropriate means of achieving this interface.

See section 8.4.2.

Recommendation 8.12 That the sponsors of the Canadian Construction Management Development Institute be urged to continue their financial support as a means of upgrading the technical capability of the industry.

See section 8.4.3.

Recommendation 8.13 That the federal government continue to examine the state of construction RD&D and take appropriate action to facilitate both the development and dissemination of technology in the construction industry.

See section 8.4.5.

Recommendation 8.14 That the federal government and industry representatives develop a strategy to exploit advanced Canadian construction technology for foreign markets.

See section 8.5.2.

1.3.5 Chapter 9 Construction in Remote Regions

Recommendation 9.1 That governments cooperate to establish a clear and comprehensive policy on construction activities in the North and remote areas with stated objectives to assist people in remote areas and to upgrade the program of services available in these regions.

See section 9.3.

Recommendation 9.2 That governments, as part of a national industrial policy, cooperate to formulate and implement a uniform approach in the development of resource industries and all of the necessary infrastructure.

See section 9.3.

Recommendation 9.3 That a conscious and concerted effort by native groups, industry, organized labour, and governments be directed to the development of education and training programs to meet native needs and to encourage native participation; that all parties be encouraged to continue the practice of preferential employment of bona fide northern residents qualified to perform the work; and that preemployment training, apprenticeship, and on-the-job training facilities be expanded to permit increasing numbers of northerners to be trained in the construction trades.

See section 9.3.

Recommendation 9.4 That the federal government's present intention to tax northern allowances be permanently rescinded.

See section 9.4.1.

Recommendation 9.5 That the federal government recognize that high costs will remain a fact of life in the North and other remote areas; and that the government enact tax measures that will encourage development and attract a skilled work force.

See section 9.4.1.

Recommendation 9.6 That authorities recognize that employment conditions in the North demand special treatment not necessarily required in the more developed southerly regions; that employment standards and conditions be tailored to northern requirements to achieve maximum use of manpower; that recognized apprenticeship programs in indentured trades not be diluted; and that skill standards must be maintained for safe and efficient completion of construction projects.

See section 9.4.2.

Recommendation 9.7 That a unified and coordinated approach to environmental protection be established, serving both the need for the development of economic resources and the protection of the natural environment; that neither requirement be given precedence over the other; and that a comprehensive cost-benefit impact study be developed as early as possible for each major construction project.

See section 9.4.3.

Recommendation 9.8 That governments and the private sector together work towards the creation of an economic environment for Canada that will be conducive to a rational and effective development of the resource-based industries in remote regions.

See section 9.4.4.

Recommendation 9.9 That the comprehensive plan for northern development urged in Recommendations 9.1 and 9.2 respond to the needs of the indigenous population and protection of the environment, but nonetheless to the ultimate realization of the vast potential of the region; that it be recognized that it will not be acceptable to permit the area to develop without the establishment of appropriate policy guidelines; and that the federal government take the lead role and involve all other levels of administration.

See section 9.5.

Recommendation 9.10 That labour agreements not be imposed on the development of the North, but be the result of negotiations between employers and unions; and that basic conditions appropriate to labour agreements in remote areas be established by legislation.

See section 9.6.1

Recommendation 9.11 That the concept of equal pay for equal work be accepted and discrimination against the indigenous population be prevented; and that travel and living allowances be accepted as a means of overcoming the resistance to mobility of the work force.

See section 9.6.2.

Recommendation 9.12 That government, owners, and the construction industry adopt a pragmatic approach to incentives designed to attract workers to remote construction sites and that the approach be consistent with current general conditions and those pertaining to the project in question.

See section 9.6.6.

Recommendation 9.13 That a Centre (or Centres) for Cold Weather Construction Research and Development be established as soon as possible in order that the Canadian construction industry and its clients may benefit from the knowledge developed.

See section 9.6.6.

1.3.6 Chapter 10 Report of the Major Projects Task Force

Recommendation 10.1 That an early start be made on the systematic gathering and dissemination of pertinent information on the demand for services, material, equipment, financing, and labour for major projects; that these inventories be conducted by a non-governmental agency that can ensure confidentiality; that inventories be gathered and defined according to a known and agreed set of criteria and analysed in as sophisticated a manner as possible; that inventories be current; that, as a minimum, totals in categories be presented as probabilistic ranges.

See section 10.2.

Recommendation 10.2 That priority attention be given to Recommendations 1, 2, 3, 9, 14, 18, 19, 23, 24, 25, 26, 27, 32, and 33 of the Major Projects Task Force.

See section 10.3.

Recommendation 10.3 That the pursuit of Canadian content goals not create barriers to the use of external technology in cases where such use is in the overall national interest.

See section 10.4.4.

Recommendation 10.4 That the Canadian government be a flexible, proactive supporter in its ongoing efforts to create a policy environment that would encourage Canadian industry to compete successfully in foreign markets against the government-supported programs of foreign nations.

See section 10.4.5.

Recommendation 10.5 That provisions for the payment of a premium for Canadian goods and services supplied to major projects as a general requirement be discussed by interested parties with a view to increasing Canada's long-term industrial strength; and that in the meantime, the payment of preferential premiums be negotiated on a project-by-project basis.

See section 10.4.6.

Recommendation 10.6 That the Government of Canada undertake an extensive review of the process of developing Canadian standards and of current Canadian standards from the standpoint of assuring their competitiveness in world markets.

See section 10.4.7.

Recommendation 10.7 That governments and owners encourage and support initiatives by the construction industry and research organizations devoted to research programs on ways and means of removing or reducing factors that impair productivity in the realization of major projects.

See section 10.5.1.

Recommendation 10.8 That careful consideration be given to an examination of (a) the real benefits of major projects and how such benefits can be optimized and (b) the possible negative consequences of major projects and how the regions affected and the nation as a whole could best minimize damages.

See section 10.5.2.

Recommendation 10.9 That in the interests of the nation, the Government of Canada sponsor a highly pragmatic study of Canadianization to provide factual cost/benefit data to be incorporated in an appropriate strategy that encourages development and recognizes Canada's position as a member of the world economy.

See section 10.5.3.

Recommendation 10.10 That in view of the importance placed on the development of the manage-engineer-procure-construct sector of the industry and the sector's contribution to the health and growth of the industrial manufacturing sector, to Canadian exports, and to the development of technology in Canada, the government fund, in conjunction with industry, a comprehensive research program into all aspects of capital projects realization with special emphasis on the MEPC sector.

See section 10.5.6.

2 Definitions

2.1 Introduction
2.2 Capital Investment Projects
2.3 Construction: The Capital Projects Realization Industry
2.4 Sectors
2.5 Industrial Projects and Infrastructure Projects
2.6 Elements

2 Definitions

2.1 Introduction

"Construction" — the word conjures up different meanings to different people — and most of these meanings are probably incomplete or badly outdated!

Like the submissive spouse of thirty-five years' standing, the construction industry tends to be taken for granted and is not fully understood or appreciated.

In earlier times, construction was mainly housing. Statistics were compiled on "residential construction" and the balance was negatively dismissed as "non-residential". The custom persists even though the latter's volume has come to exceed that of housing twofold or threefold!

Similarly, some economists still classify construction as a "service industry". True, construction does provide construction service to its customers, but it is basically a production industry. The industry produces a vast array of new capital assets ranging from a modest house to a huge energy project.

The image of on-site construction personnel has perhaps progressed from the popular folklore of the plumber who forgets his tools and the road worker leaning on a shovel to that of the "hard hat". But even this falls far short of all of the other vital sectors in the construction process — the manufacturers of equipment, plant, components, materials, and tools; the architects and design engineers; the owners and operators of built works; and the suppliers of testing, insurance, and other services — as well as the contractors and their on-site forces.

It is vital that our terminology be forward looking and appropriate for the present and future roles of the construction industry rather than be outdated and retrogressive. The following terms are used frequently in this report. They are defined in some detail in order that there may be a clear understanding of their meaning.

2.2 Capital Investment Projects

Capital Investment Projects are those parts of capital formations that are employed to create physical plant, equipment, and facilities, whether fixed or mobile. They are exclusive of capital employed to carry inventories, for long-term promotions in marketing, or for the purchase of good will or existing enterprises, but they do include early expenditures for concept, research, and development that in certain systems may be capitalized. Capital investment projects may include new facilities ("greenfield") or the expansion or improvement of existing facilities to eliminate obsolescence or to achieve higher productivity goals; but capital investment projects do not include replacement of normal wear and tear or maintenance requirements.

2.3 Construction: The Capital Projects Realization Industry

For the purposes of this report, as in the real working of the capital projects realization system, the *Construction Industry* is defined as the industry that produces capital investment projects. It is therefore the *Capital Projects Realization Industry*. It comprises all the activities of those whose tasks involve conceptualization, research, exploration, development, demonstration and prototypes, feasibility assurance, regulations, codes and permits, design, procurement (including the manufacturing, marketing, and distribution of construction materials and capital machinery and equipment), construction, erection, and commissioning. These activities may be performed in-house by private owners or by governments in whole or in part but in the main are done by private corporations under contract to the owner-investors. Finding capital funds and operating the completed facilities are the realm of the owner. At times, members of the construction industry also perform or assist in these functions.

In addition, the construction industry is engaged in construction repair work, which amounts to roughly 20 per cent of the total construction program.

PER CENT OF TOTAL CONSTRUCTION 1982

2.4 Sectors

The *Sectors* of the construction industry are those divisions whose members perform activities of a like nature that are often sequential in the various phases of a construction project. Because of their common or similar activities, sectors join in *Business Associations* at municipal, provincial, and national levels to work for their common good; to improve their performance; and to represent themselves to the owner-investors, governments, and those with whom they interface in the other sectors of the industry. A list of the main sectors and their principal business associations are provided in Appendix B.

A good many technological associations and learned societies also serve sectors of the industry.

The construction industry has a complex configuration and working system because of its search for efficiency, which causes an ongoing evolution of specialties. This specialization and its

THIRTEEN SECTORS
MANY SUBSECTORS

related technological growth and development are the industry's great strength. Its achievements in the service of mankind over the decades result from its free association and very competitive nature. Many sectors of the construction industry consider that they are an industry unto themselves, not part of a whole. This is a strong philosophy.

2.5 Industrial Projects and Infrastructure Projects

Capital investment projects need to be sorted into classes according to their purpose so that their value to the economy is understood. There are two major classifications: *Industrial Projects* and *Infrastructure Projects*. The industrial, or goods-producing, projects process the material resources of Canada through sequential stages for eventual consumption by mankind. Infrastructure projects, in the broadest sense, contribute to the support of industrial projects and to improvements in the quality of life of mankind. Examples of primary resource industrial projects include agri/fish food culture, forest products, gas and oil, and mineral and energy production. These projects are followed by secondary and tertiary treatment to produce intermediate products or consumer products. Examples of infrastructure projects include transportation, accommodation, utilities, educational and government facilities, communications, and commercial services.

2.6 Elements

The activity breakdown of projects provides the *Elements*. The four main headings of elements are

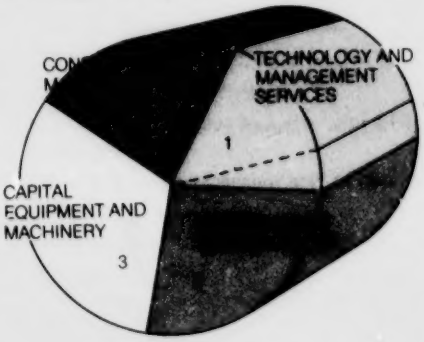
1. technology and management services
2. construction trades labour
3. capital equipment and machinery
4. construction material.

Technology and management services comprise the functions of planners and process engineers, designers, erectors and contractors, risk management and finance corporations, and construction equipment whose costs are distributed over the entire project.

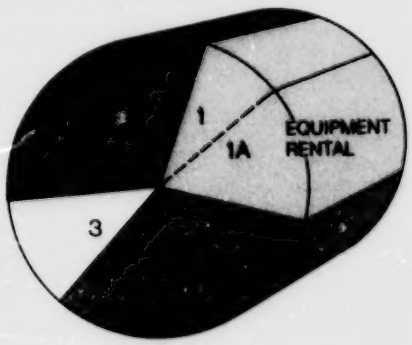
From the elements of project work evolve the sectors defined above.

ACTIVITY BREAKDOWN STRUCTURE OF PROJECTS

INDUSTRIAL PROJECTS



INFRASTRUCTURE PROJECTS



3 Construction: The Capital Projects Realization Industry

3.1 The Medium for Economic Growth
3.2 Creators for Others
3.3 Organizational Evolution
3.4 Efficiency through Specialization
3.5 Industry Sectors
- 3.5.1 Exploration and Development Firms
- 3.5.2 Process Purveyors
- 3.5.3 Design Professionals
- 3.5.4 Machinery Designers, Manufacturers, and Suppliers
- 3.5.5 Construction Material and Component Manufacturers and Suppliers
- 3.5.6 General Contractors
- 3.5.7 Specialty Civil Contractors
- 3.5.8 EPC Contractors
- 3.5.9 Trade Contractors
- 3.5.10 Construction Management and Project Management Firms
- 3.5.11 Developers
- 3.5.12 Residential Builders
- 3.5.13 RRR Contractors

3.6 A People-intensive Industry with a High Potential for Entrepreneurial Advancement
3.7 High Canadian Content and a Favourable Trade Balance
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3 Construction: The Capital Projects Realization Industry

3.1 The Medium for Economic Growth

The construction industry is the mechanism, or medium, for the realization of capital projects and the achievement of economic growth. The deployment of investment capital in the execution of the "engine" of industrial projects or in infrastructure projects is its business. When the industry's capacity is in a growth mode, there is tangible evidence to all that the economy is healthy and that people's future welfare will be more secure.

Growth stimulates people's search for improvement and the personal satisfaction they derive from achievement. Growth also provides security and makes funds available for cultural and leisure activities. Growth at a satisfactory rate offsets the stagnation, obsolescence, and loss of pride that otherwise occur.

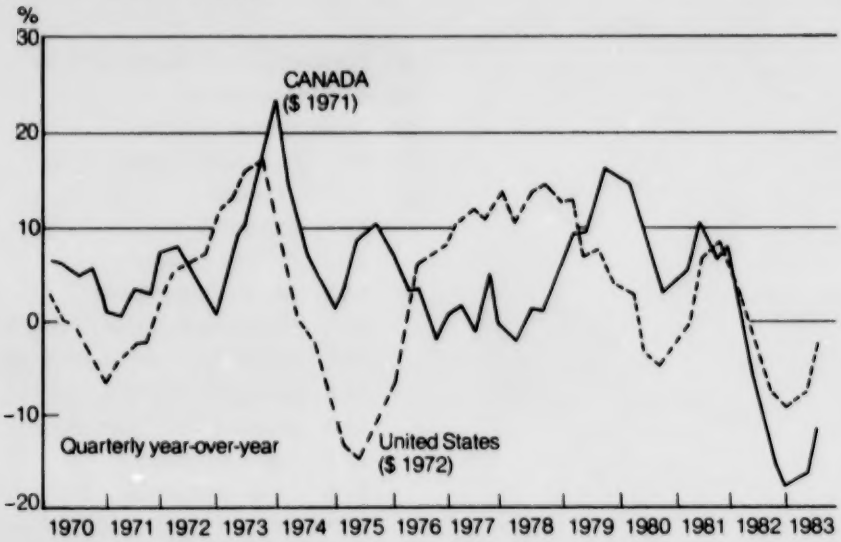
The main objectives of the capital projects realization industry are to produce projects that increase people's productivity and to provide material goods for people's needs.These project investments, for service mainly for five to fifty years, are successful when these objectives are met. The dictates of man's ingenuity, resourcefulness, and creativity reduce such planned time spans and create additional projects. Such growth flourishes in free, uninhibited systems in open competition.

3.2 Creators for Others

The construction industry's obligation is to produce a series of projects that are rarely similar in detail and are widely diverse in magnitude and configuration. In most cases, members of the construction industry do not enjoy the fruits of their labours in the sense of operating the completed projects. The individual member company of the construction industry may suffer a financial loss in its effort to create a successful project, which often brings handsome returns for decades to the owner, the investors, and the public at large.

The construction industry has traditionally been very competitive. The peaks and troughs of the business cycle are exacerbated in the construction cycle

CHANGES IN BUSINESS INVESTMENT IN CONSTANT DOLLARS: CANADA AND UNITED STATES



Source: Statistics Canada and U.S. Department of Commerce

and create intensive times of boom or bust for the industry's members. For this reason and because it is people oriented, the construction industry is highly flexible and innovative, requiring special leadership personnel and the intensive use of leading-edge management techniques.

3.3 Organizational Evolution

The structure of the construction industry in North America became markedly different from that of its antecedents in Western Europe during the first quarter of the present century.

The differences became particularly evident during the subsequent decades. The open-market pursuit of excellence caused the decline of the generalist and the rise of the specialist. Building trades unions, specialty and trade contractors, and manufacturers of building and process systems evolved and flourished. In keeping with the general trend towards specialization, the design disciplines also increased in number.

On major projects, the firms that prospered knew how to cope with this wave of specialization and recognized that technology is the core of the construction industry. Special management methods, using to the full extent a wealth of highly skilled and forefront specialty people and organizations, were required to plan, organize, and produce results. In this way, the large North American-based international engineer-construct organizations evolved, each with its own strengths but with almost identical operating methods and structures.

Many large Western European national and private engineer-construct organizations followed suit and organized in this style. However, there remains an essential difference: the major European — and now Japanese — international organizations are more closely integrated with capital equipment manufacturing operations, the investment banking industry, and with government institutions. In the United States, EPC (engineer-procure-construct) contractors are becoming members of conglomerates.

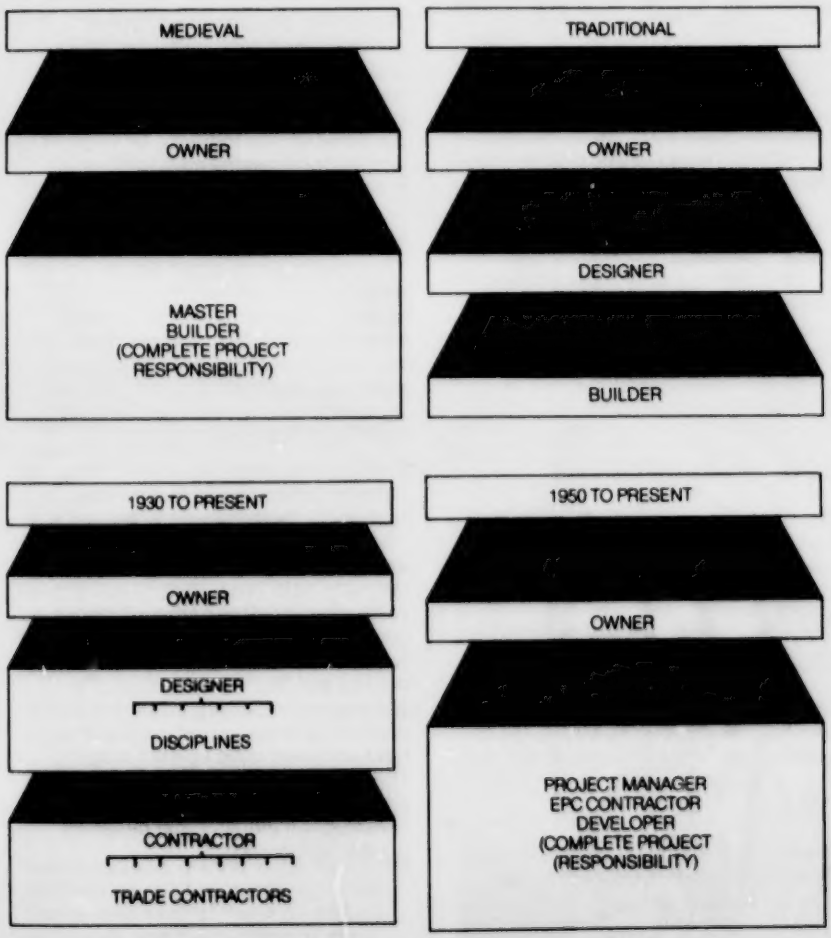
In Canada, the construction industry developed over this period in the North American pattern. In the early years, the designs of larger industrial projects were produced by the owner-clients. They were often built by foreign-based general contractors possessing some design capability whose Canadian operations eventually became owned or controlled by Canadians. The early infrastructure projects were in the main designed by private consultants and constructed by Canadian contractors.

The post-World War II period in Canada was one of relatively high industrial construction volume. Partly because of the advent of the international building trades unions and the process-oriented international EPC contractors, the structure of this sector of the Canadian construction industry changed dramatically. Probably because of family ownership and high tax burdens, the large nationally operating Canadian companies engaged in industrial contracting faded away.

In Canada in the late 1960s and 1970s, the developers and engineering consultants organized as corporations and included project and construction management capability. This development has probably been a stronger or as strong an influence on our economy as the development of the EPC contractor in industrial construction has been in the U.S. economy.

The specialty and trade contractors operating parallel to the departments of the building trades unions showed improved strength, capability, and stability over this postwar period.

COMPLETING THE CYCLE?



ON LARGER PROJECTS PARTICULARLY, THE TREND TOWARDS SPECIALIZATION HAS ENGENDERED MANAGEMENT ORGANIZATIONS TO CO-ORDINATE THE OVERALL CAPITAL PROJECT'S REALIZATION. A SIMILAR FUNCTION IS PERFORMED BY BUILDERS WHO INITIATE THEIR OWN PROJECTS.

3.4 Efficiency through Specialization

In the pursuit of excellence through specialization, sectors split up continually with the creation of new subdivisions. Such subdivision occurs primarily in three of the four elements: technology and management services, equipment and machinery, and construction materials. In the fourth element, construction labour, the building trades union movement resists further subdivision. This resistance increases the factor of solidarity and bargaining power and is therefore a strength; but its weakness is that it diminishes incentives to gain higher skills and to increase specialization. (This weakness is transformed into a strength if the members involved create a new specialty firm.)

Specialization on the part of contractors is the great strength of the structure of the Canadian construction industry. Individual competitive, private entrepreneurs are providing quality workmanship, innovative ideas, and competitive costs.

The continued advance of specialists brings with it an equivalent need for more advanced project and construction management expertise to provide the necessary coordination.

3.5 Industry Sectors

Within the construction industry, there are many sectors and subsectors. Although individual firms may operate in two or more of them, particularly in response to changes in market demand, in most cases they tend to specialize in particular types of project or work.

The diversity of these components is often not fully recognized. A brief summary of the major sectors follows.

3.5.1 Exploration and Development Firms

The companies — geophysical exploration firms, drilling contractors, etc. — that search for minerals, oil, and gas.

3.5.2 Process Purveyors

The owner-clients, capital equipment manufacturers, consulting engineers, and EPC contractors who develop for sale methodologies for industrial processes.

3.5.3 Design Professionals

The professionals from many disciplines — ranging from architects, consulting engineers, and planners to energy consultants and landscape architects — who design construction projects.

3.5.4 Machinery Designers, Manufacturers, and Suppliers

The firms that design, fabricate, and install or supply process, production, and operative equipment and control apparatus incorporated in the capital project and the construction equipment used to build it.

3.5.5 Construction Material and Component Manufacturers and Suppliers

The companies that furnish products ranging from individual building materials to preassembled components to prefabricated structures; job-site installation is also provided in many instances.

3.5.6 General Contractors

The firms that usually act as prime contractors on construction projects and provide overall coordination and often financial responsibility for their execution.

3.5.7 Specialty Civil Contractors

The firms that specialize in heavy construction projects — such as dams, marine structures, and generating stations — pipelines, roads, sewer and water installations, etc., and that usually act as prime contractors.

3.5.8 EPC Contractors

The firms that provide combined project management-engineering-procurement-construction services for industrial projects, particularly in cases where the electrical-mechanical systems are predominant.

3.5.9 Trade Contractors

The firms that execute construction work, usually principally related to a single construction trade, under contract to a prime contractor, builder, developer, subcontractor, or the owner.

3.5.10 Construction Management and Project Management Firms

The firms that act on a fee basis as the owner's agent in coordinating either the work of the trade contractors in the construction phase (CM) or also those engaged in the concept and design phases (PM).

3.5.11 Developers

The firms that typically assemble land and funds and provide project management for commercial, residential, institutional, and light industrial building projects.

3.5.12 Residential Builders

The firms that build individual houses or multiple units, usually on a speculative basis and encompassing both the design and construction phases.

3.5.13 RRR Contractors

The firms that do repair, renovation, or retrofit work on existing structures or installations, often on a jobber basis; such work may also be carried out by individual artisans.

In addition to the construction industry's resources, owners' own forces execute a sizeable portion of the total construction program. These activities range from those of the individual do-it-yourself homeowner to those of large owners who maintain their own design, project or construction management, or construction forces. As an economy matures and the construction industry's capacity expands, the economic benefits of contracting-out become better recognized, and the industry's share of total construction increases. The development of in-house capability has often taken place without any policy decision or recent review by senior management. (A CIDC checklist of factors for owners to consider when contemplating own-forces design or construction work is contained in Appendix C.)

3.6 A People-Intensive Industry with a High Potential for Entrepreneurial Advancement

The capital equipment and construction materials elements are capital intensive, and some types of contractors have heavy investments in equipment. In general, however, the composition of the construction industry, its creativity, and its performance have to do with people. In all, up to 1.5 million Canadians earn their living in the various sectors of the construction industry.

The great majority of the industry's member firms are family owned or closely held, with personal, full-time participation by their owners. Their continuity of operations over generations depends upon their ability to transfer ownership and to preserve capital in such transitional periods.

Similarly the great majority of the industry's member firms are local or regional in their operations and are "Small Business". In some sectors, the development of large nationwide or interprovincial organizations has proven to be effective. One of the industry's greatest sources of strength is its scope for the establishment of new businesses and for their individual growth. There are many examples of dedicated, capable, and risk-taking people who have achieved rapid upward mobility. This exemplification of the free enterprise system is a further feature of the construction industry that deserves greater recognition.

3.7 High Canadian Content and a Favourable Trade Balance

The construction industry in Canada is very largely Canadian owned and controlled. The principal exceptions are found among the larger contracting and manufacturing organizations. However, their activities are performed for the most part by Canadians. In the aggregate, the Canadian content of the Canadian construction program is about 90 per cent. The imported content comprises mainly technology inflow, construction equipment, process and production machinery, mechanical or electrical products, and other construction materials.

Members of the Canadian construction industry also export their goods and services. Exports include forefront Canadian technology in various types of industrial and infrastructure projects, machinery and equipment, real estate developments, and lumber and other construction materials.

The balance of trade for the construction industry is currently in favour of Canada. Exports exceed imports by approximately $1 billion a year, or roughly 2 per cent of the capital projects realization program.

3.8 The Past is Prologue

The construction industry in Canada has many great achievements to its credit. Canadian industrial plant and infrastructure have attained a level of excellence that compares well with that of any area of the world and are far in advance of any area with such a low population density. This excellence has been brought about through the free acceptance for Canadian projects of the best technology in the world and the skill and capacity of Canadian industry to train and develop its people in the most advanced methodologies.

Examples of such achievements in the 1940s included world-scale war plants and a network of training establishments; in the 1950s, the modern consumer industry plants; in the 1960s, the modernization of resource industries, the development of major oil and gas resources, and the building of major infrastructure projects; and in the 1970s, large-scale programs in Western Canada. The latter development was relatively unnoticed or poorly understood by most Canadians. The result was that the construction industry's contribution to Canadian prosperity and growth was not as apparent as in previous decades.

What of the balance of the century? The nature and structure of the Canadian construction industry during the early 1980s have been affected by not only the recession but also the growing regional emphasis in Canadian affairs. For example, the potential place of the nationally operating general, industrial, or heavy construction contractors is being taken largely by international contractors operating with Canadians from Canadian bases. These firms enjoy strong financial resources derived from worldwide operations and the security of approbation in their home markets.

At the present time, there are a number of world-class Canadian firms in all construction sectors but the contractor categories. Part of the industrial strategy for the 1980s should be to develop some world-class Canadian construction companies and to increase the number of world-class firms in the other sectors.

4 Focus on Construction's Future

4.1 Market Forces

4.2 Developed or Developing? — The Canadian Conundrum

4.3 Possible Future Developments in the Canadian Construction Industry

- **4.3.1** Exploration and Development Firms
- **4.3.2** Process Purveyors
- **4.3.3** Design Professionals
- **4.3.4** Machinery Designers, Manufacturers, and Suppliers
- **4.3.5** Construction Material and Component Manufacturers and Suppliers
- **4.3.6** General Contractors
- **4.3.7** Specialty Civil Contractors
- **4.3.8** EPC Contractors
- **4.3.9** Trade Contractors
- **4.3.10** Construction Management and Project Management Firms
- **4.3.11** Developers
- **4.3.12** Residential Builders
- **4.3.13** RRR Contractors
- **4.3.14** Construction Labour

4.4 Appropriate Related Government Structures

4 Focus on Construction's Future

4.1 Market Forces

The construction industry's role as the medium for economic growth was described in section 3.1. To fulfil this role effectively, industry members must have a greater awareness and understanding of the economic forces, events, and policies that shape investments in capital projects. This in turn will enable the industry, using modern management methods, to develop its own resources to maximum advantage.

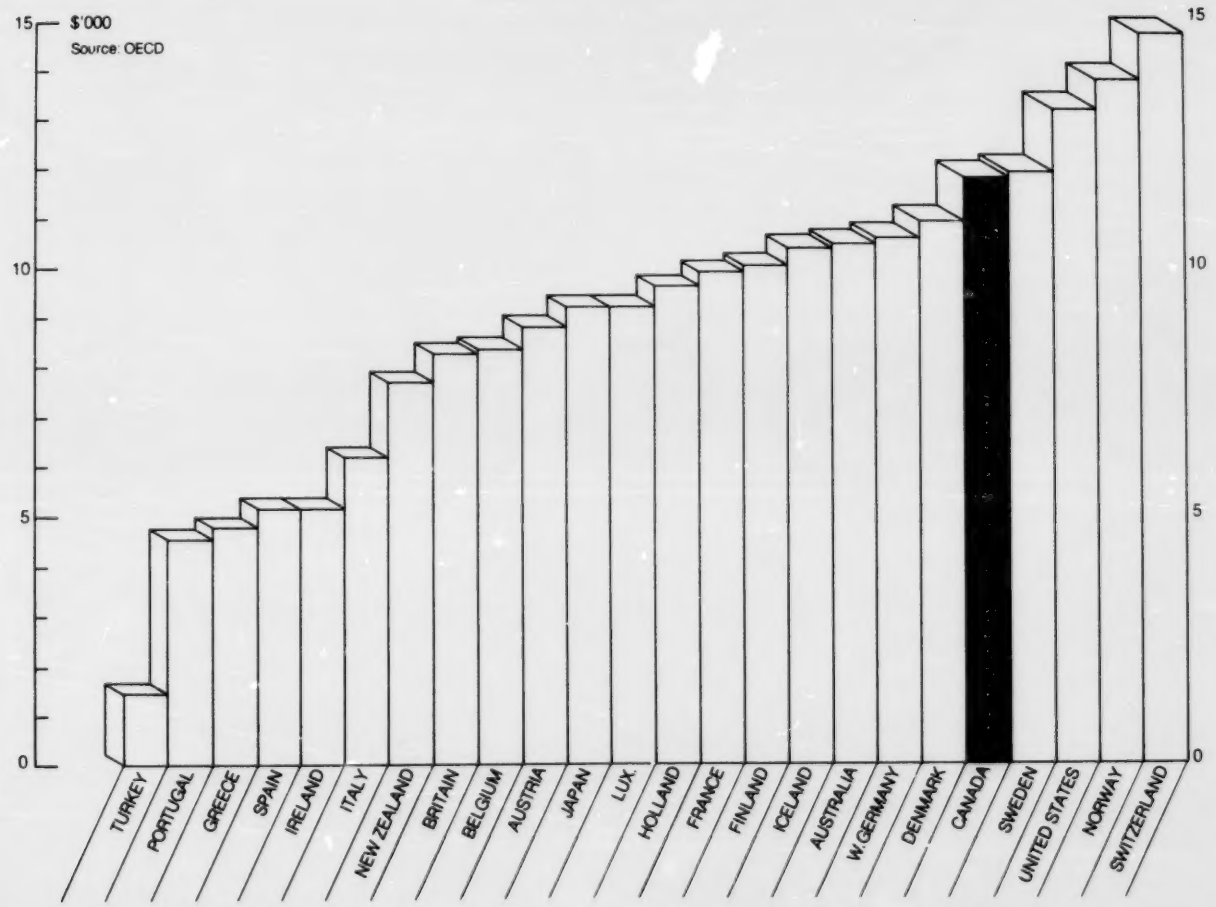
Canada is a leading industrial nation and enjoys one of the highest per capita incomes and standards of living in the world. However, many plants built twenty, thirty, or more years ago are now outmoded. A vigorous regeneration of investments of advanced technology is needed to maintain or obtain a competitive position. The capital investments of the present decade for both new and modernized facilities will largely determine Canada's future productivity, international competitiveness, and general economic status.

Among the factors that merit greater examination are the nature and availability of capital formation; the allocation of savings and borrowings on assets to capital investment; and the share of gross national product (GNP) devoted to capital projects and, within this program, to industrial and infrastructure projects. Such market analysis should be applied not only to the Canadian scene but also to other nations on at least a selective basis.

4.2 Developed or Developing? — The Canadian Conundrum

As a nation matures industrially, it is normal for it to devote a smaller proportion of its GNP to construction. The bulk of its production facilities and infrastructure has already been built. However, this factor should not be accepted as the justification for the decline of construction's share of Canada's GNP from a postwar high of 22 per cent to 16 per cent in 1982.

PER CAPITA GNP IN OECD MEMBER COUNTRIES: 1982



Notwithstanding Canada's position as one of the world's most industrialized countries, it has within its borders a mixture of all levels of economic development.

Only relatively small sections of the total land mass in the southern portions of Quebec and Ontario and in the lower British Columbia mainland are in an advanced state of industrial development and show some signs of post-industrial stress.

The balance of the southern portion of the country could be described as still developing or as lesser developed regions. The southern interior regions of the Western provinces, for example, have a great potential for continued and rapid growth. The stimulus of offshore resources development could have a similar effect in the Atlantic provinces.

The areas farther north in the Canadian Shield, the Mackenzie Valley, and adjacent western regions are now sub-lesser developed, although on the brink of substantial resource exploration and development. The High Arctic is one of the few regions whose development potential is relatively unknown.

Taken as a whole, Canada is still very largely a "developing nation". Accordingly, the current 16 per cent share is too low. The restoration of a share of GNP of 20 per cent or more for construction activity could again be appropriate if the country is to develop further industrially.

Similarly, the shares of the total construction program consisting of industrial projects and of infrastructure projects merit analysis. The two broad classifications of projects are interdependent, but greater emphasis on one type may be desirable, depending upon conditions. In the long run, the ability to fund infrastructure projects depends largely upon the revenues of the goods-producing industrial projects. On the other hand, an industrial operation requires supporting infrastructure, such as transportation facilities. Timing may also affect the ratio of industrial to infrastructure projects. Many of the latter are publicly funded or assisted (for example, roads, housing, and institutional projects) and may be deliberately scheduled for times of recession.

4.3 Possible Future Developments in the Canadian Construction Industry

The construction industry's structure and activities will continue to evolve to better meet the needs for more efficient, cost-effective industrial facilities and supporting infrastructure so fundamental to Canada's economic progress.

Predictions are particularly perilous in a dynamic industry. However, a vigorous and positive approach yields the following possible scenario for the various sectors listed in section 3.5.

4.3.1 Exploration and Development Firms

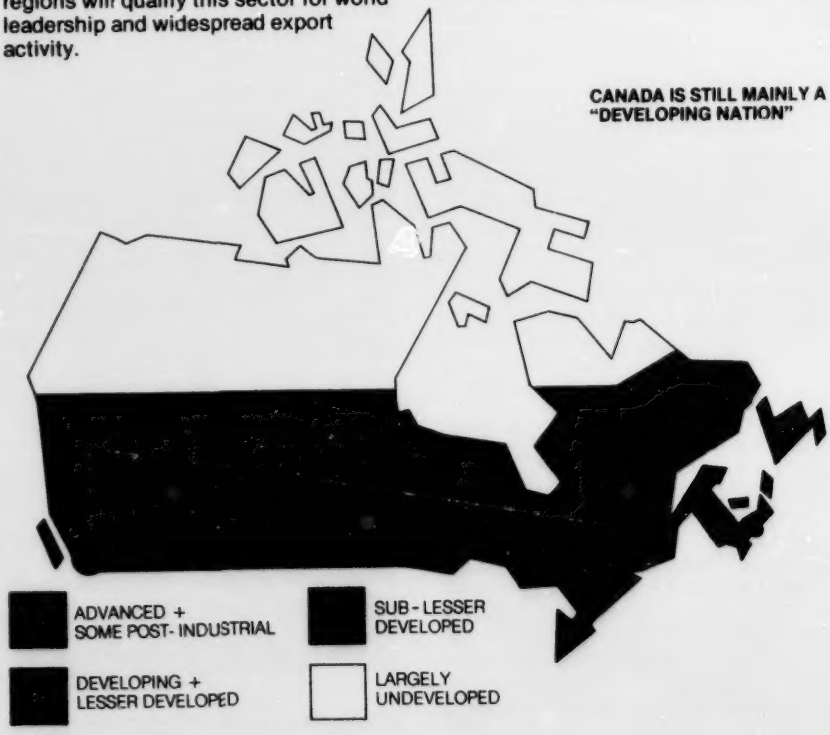
The use of computers and satellite communications will facilitate the continuation of the concentration of company expertise in Calgary for minerals and oil and gas projects making it the Canadian centre of excellence for this sector. The additional experience gained in its application, often under rigorous conditions, to the enormous potential in Canada's land mass, High Arctic, and offshore regions will qualify this sector for world leadership and widespread export activity.

4.3.2 Process Purveyors

The link between the development of advanced process technology and capital equipment manufacturers will become more prevalent. As the computerized operation of process plants evolves, the capital cost of computer equipment will increase rapidly in importance as a component of the total cost of a project. In both areas, multinationals will attain dominant positions, but noteworthy breakthrough developments will still occur in small specialty and innovative organizations.

4.3.3 Design Professionals

Architectural and consulting engineering firms that design infrastructure projects will continue to operate primarily in regicnal markets. The trend to agglomeration among consulting engineering firms active in industrial projects and infrastructure projects with a high mechanical-electrical content will continue. The large national firms will expand their project management skills and procurement interface with the process purveyors. Affiliations, consortia,


CANADA IS STILL MAINLY A "DEVELOPING NATION"
ADVANCED + SOME POST- INDUSTRIAL
SUB - LESSER DEVELOPED
DEVELOPING + LESSER DEVELOPED
LARGELY UNDEVELOPED

or mergers with large general contractors will occur to strengthen construction management and direct hire capability. These developments will in turn improve export capability. At the same time, small, highly specialized firms will continue to provide valuable services, and improved communication systems will permit them to apply their skills more widely. Computers will reduce markedly the work force of design professionals per unit volume.

4.3.4 Machinery Designers, Manufacturers, and Suppliers

As noted in section 4.3.2, this sector will become more dependent upon agglomeration with multinationals for conventional business. Computer-aided design and manufacturing (CAD/CAM) and robotics will lead to increased use of mergers with design engineers. Single-product manufacturers will give way to those with diversified product lines. There will be more plants with mandates for world markets. Improved transportation systems that can carry heavier loads will facilitate the prefabrication of larger modules of factory-assembled process equipment.

There will be more participation in turnkey projects, with the equipment supplier acting as a member or leader of consortia. Notwithstanding the above trends favouring the large multinationals, small shops with special product lines adapted to the needs of the local construction industry will flourish, particularly in developing areas.

4.3.5 Construction Material and Component Manufacturers and Suppliers

Competition among alternate construction materials, components, and structures will continue to foster research and development, high-technology quality output, and good availability. The trend towards more off-site fabrication will continue. Vertical integration by producers of basic construction materials, manufacturers of products incorporating them, and contractors installing them will become more prevalent. The operations of suppliers will continue to provide an excellent example of the application of computerized systems of inventory and purchasing control.

4.3.6 General Contractors

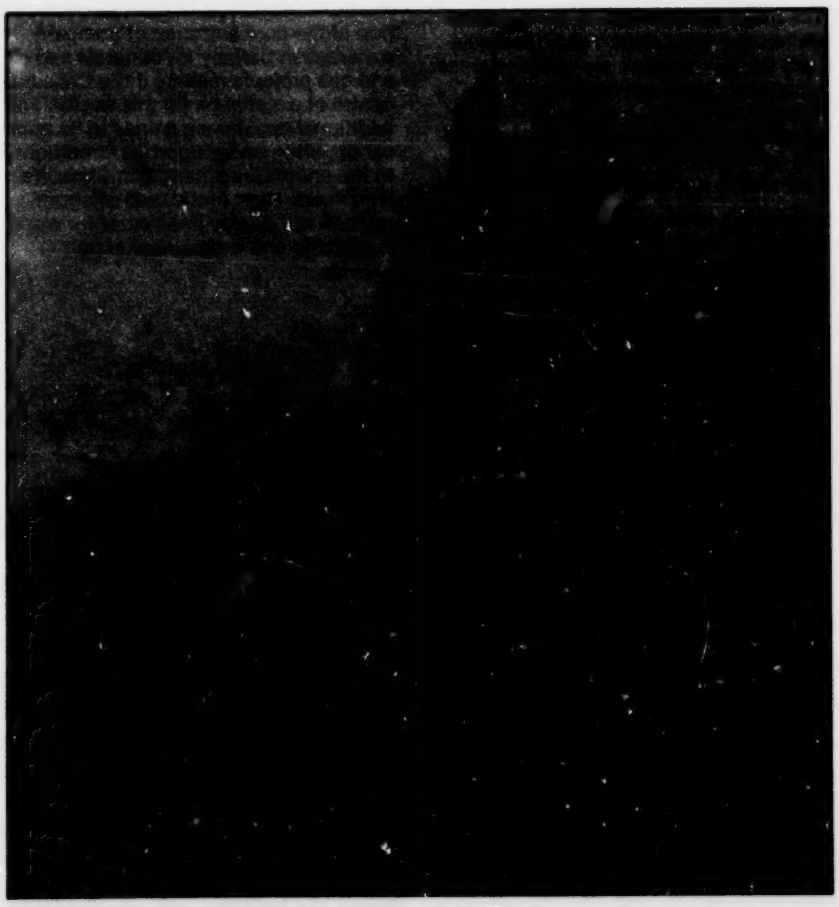
The age of specialization will cause "general" contractors to specialize in building construction. Diversification to include the roles of construction managers, developers, or developers' agents or the regaining of certain on-site construction activities will likely become increasingly necessary to maintain business volume.

4.3.7 Specialty Civil Contractors

Large projects, such as major dams, generating stations, and pipelines, will continue to attract national and international firms that seek work far from their home base. A greater degree of specialization and of regionalization will likely develop with regard to roads, sewer and water installations, and other projects executed by this sector.

4.3.8 EPC Contractors

The trend of foreign EPC firms and Canadian-owned entities jointly undertaking industrial projects in Canada will continue. As expertise accumulates, the Canadian firms will become more independent in both the domestic and export markets. If sizeable volumes are achieved in both areas over the next two or three decades, a few Canadian EPC firms that specialize in certain product lines or technology areas will be sustained.



COMPUTER-DRAWN THREE-DIMENSIONAL DRAWINGS ASSIST BOTH DESIGNERS AND CONSTRUCTION PERSONNEL IN VISUALIZING PROJECT DETAILS.

4.3.9 Trade Contractors

The structure of this sector will probably not change except to accommodate further specialization into subtrades and the advent of new materials that require the development of new trade installation contractors. Efficiency will increase through increased management training and computerization.

4.3.10 Project Management and Construction Management Firms

Increased attention will be given throughout the industry to the development of management skills in the execution of construction projects. The operation of separate firms of management consultants to provide such skills will require that they can offer personnel who have obtained experience in other sectors. Indeed, the offering of such services will often be as an adjunct to the organization's primary role.

4.3.11 Developers

This sector is subject to the dictates of a highly volatile market. The large-scale expansion of major Canadian developers' activities in the United States was largely in response to reduced scope in Canada for their high standards of management, financial, and technological expertise derived from their operations in this country. The redevelopment of the decayed cores or otherwise underused sections of our cities and an economic upturn could combine to bring about a resurgence of large commercial and institutional projects by developers. Meanwhile, developers with low overheads will continue to be active.

4.3.12 Residential Builders

Although present demographic and other factors indicate a reduction in the number of housing starts in Canada, it is possible that this reduction will not occur to the same degree in the value of future residential construction programs. Greater emphasis on multiple-unit housing, urban renewal, and a desire by those who have been buying modest homes in recent years to upgrade their accommodation are among the stimulants to housing activity. The basic desire to live in an individual house remains strong. The structure of the residential builders will continue to adapt to meet changing markets. An increase in immigration would affect this sector's potential market more than any other.

4.3.13 RRR Contractors

In response to many factors, including high costs of serviced land, the need to conserve energy, and changing life styles, the markets for repair, renovation, and retrofit will continue on the upswing. Different skills are involved, and such work is frequently carried out by new types of organizations formed to meet new or expanding opportunities.

4.3.14 Construction Labour

This element of the construction industry will undergo appreciable change in the next two to three decades. Following its recent reorganization at the national level for greater control of its own destiny, construction labour will tend to increase its dialogue and participation with management for the welfare of its membership and for the construction industry as a whole. Many changes in rules on jurisdiction, mobility, travel, and management rights will occur, with ensuing benefits to productivity. Productivity standards will be in evidence; rates of pay will be more responsive to work regimes and skill and training requirements of activities; training will be more effective at journeymen and supervisory levels; and more emphasis will be placed on methods of obtaining job satisfaction. There will be much more off-site fabrication, and on-site manpower levels will fall by as much as 25 per cent in total and particularly for labourers and form carpenters.

Construction equipment and tools will be greatly improved, and savings in site labour will be achieved through the application of computer controls to much heavier and more precise transporting, lifting, and levelling equipment. Improved participation with management will augment better and more precise scheduling of material delivery and trades sequences, information displays of construction drawing, and quality assurance programs.

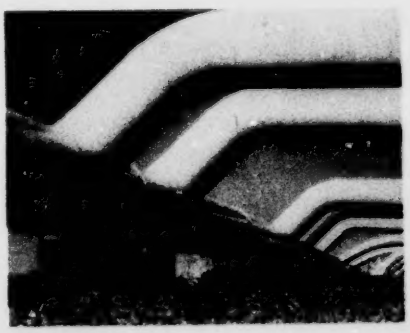
4.4 Appropriate Related Government Structures

Whereas the construction industry's structure changes constantly in response to new conditions, the structure of governments in Canada related to the construction industry has been largely static. There is a similar need for government structures to change to give the necessary recognition and support to the modern capital projects realization industry.

All levels of government in Canada have traditionally been structured merely to accommodate their own needs for construction infrastructure. Departments of public works, highways, housing, government services, etc., have been mandated to administer contracts or build or maintain municipal services, institutional buildings, transportation facilities, public housing, defence installations, or other public works projects.

Valuable assistance has been given specifically to the construction industry in the areas of education, training, and research. However, *there is no general recognition in government structures in Canada that construction is a basic contributor to overall economic growth and merits strong developmental support.* Indeed, construction is often excluded from such support programs. There is no department equivalent to those that have long operated to help promote the growth and welfare of agriculture, forestry, mining, or fishing and, more recently, communications — yet construction is far more important in terms of GNP share and employment than any of tne above industries.

Moreover, a healthy construction industry is most important to such other industries because construction's efficiency has a direct effect on their own efficiency.



5 The Canadian Construction Program, 1970-1990

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5 The Canadian Construction Program, 1970-1990

The program that the Canadian construction industry will realize in the present decade will be sketched in this chapter, but not without peril.

Forecasting is both the easiest and the most treacherous exercise to undertake. Once a list of assumptions has been made and a set of rules established, the conclusions follow necessarily. From that viewpoint, a forecast cannot be wrong. But the assumptions can fail to materialize, and the whole exercise then becomes highly misleading. The past two years have shown dramatically how quickly certain basic assumptions may have to be revised.

Nevertheless, some figures will be put forward. Before doing so, a summary review of the basic trends of the past decade will help give some perspective.

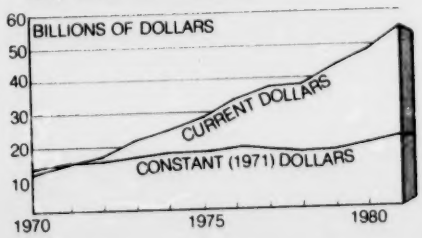
TABLE 5.1

TOTAL VALUE OF CONSTRUCTION WORK PERFORMED AND YEAR-TO-YEAR PERCENTAGE VARIATION, CANADA, 1970–1981

Year	In Current Dollars		In Constant (1971) Dollars	
	Value ($000 000)	Percentage Variation	Value ($000 000)	Percentage Variation
1970	13 781	4.5	14 711	−0.6
1971	15 865	15.1	15 865	7.8
1972	17 289	9.0	16 327	2.9
1973	20 174	16.7	17 294	5.9
1974	24 693	22.4	17 859	3.3
1975	28 376	14.9	18 318	2.6
1976	33 131	16.8	19 343	5.6
1977	35 803	8.1	19 198	−0.7
1978	38 190	6.7	19 036	−0.8
1979	43 023	12.7	19 495	2.4
1980	48 327	12.3	20 325	4.3
1981	56 957	17.9	21 410	5.3

SOURCE: *Construction in Canada*, Statistics Canada, publication no. 64-201, 1970-1971, p. 10 (Table 2), and 1980-1982, p. 10 (Text Table II).

VALUE OF CONSTRUCTION WORK PERFORMED IN CURRENT AND CONSTANT DOLLARS



PERCENTAGE VARIATION IN CURRENT AND CONSTANT (1971) DOLLARS

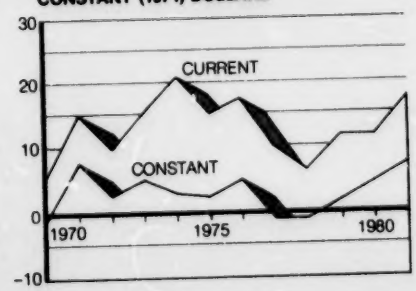


TABLE 5.2

PERCENTAGE DISTRIBUTION OF TOTAL VALUE OF CONSTRUCTION WORK PERFORMED BY TYPE OF CONSTRUCTION, CANADA, 1970-1981

Type of Construction	Year				Change
	1970	1975	1977	1981	
Total construction	100	100	100	100	
Building construction	*58.8*	*58.5*	*59.5*	*53.6*	
Residential	29.1	30.6	36.7	28.3	—
Industrial	7.3	5.3	4.8	5.2	
Commercial	9.3	13.2	10.2	12.6	
Institutional	9.7	5.5	4.6	4.3	—
Other	3.4	3.9	3.2	3.2	
Engineering construction	*41.2*	*41.5*	*40.5*	*46.4*	
Marine	1.1	0.6	0.7	0.6	
Roads, highways, and airport runways	9.3	8.4	7.5	6.9	—
Waterworks and sewage systems	3.5	4.4	4.7	4.1	
Dams and irrigation	0.4	0.5	0.5	0.5	
Electric power construction	8.9	10.0	9.5	8.8	
Railway, telephone and telegraph construction	4.1	3.9	3.8	3.8	
Gas and oil facilities	7.9	6.5	7.6	15.3	+ +
Other	6.0	7.2	6.3	6.4	

SOURCE: *Construction in Canada*, Statistics Canada, publication no. 64-201, 1970-1972, p. 7 (Table 3), and 1979-1981, p. 12 (Table 3).

5.1 The Decade of the 1970s

5.1.1 The Value of Work Performed

The value of the construction work performed increased, in constant dollars, by about 35 per cent during the decade (see Table 5.1). This total value still represents approximately 16 per cent of the gross national product or expenditure. But this increase of 35 per cent was not spread out evenly over the decade.

The total value of construction work, in constant dollars, increased around 6 per cent in 1971, 1973, and 1976, but it declined slightly in 1977 and 1978. (A modest annual increase began in 1979 and continued until a sharp drop in volume was experienced in 1982.)

5.1.2 The Sectoral Distribution

More important is the distribution among the various types of construction, shown in Table 5.2. The general distribution remained fairly stable until 1975, when important changes started to appear.

Residential construction, after an excessive surge in 1976-1977, started a serious decline. The share of residential construction in the total had grown from 30 per cent to 37 per cent in two years; by 1981, it was well below 30 per cent.

Other subsectors of the infrastructure sector also moved differently. The share of institutional building construction dropped steadily during the decade. Demographic changes and government restraint programs have had a considerable effect on this type of construction. A decline in road building is also noticeable. The part of the construction program initiated by public utilities has remained quite stable.

Conversely, the industrial, or goods-producing, projects experienced a considerable increase, which was concentrated in gas and oil facilities. Light industrial construction declined somewhat as a percentage of the total volume of construction.

TABLE 5.3

PERCENTAGE DISTRIBUTION OF TOTAL VALUE OF CONSTRUCTION WORK PERFORMED BY PROVINCE, 1971-1981

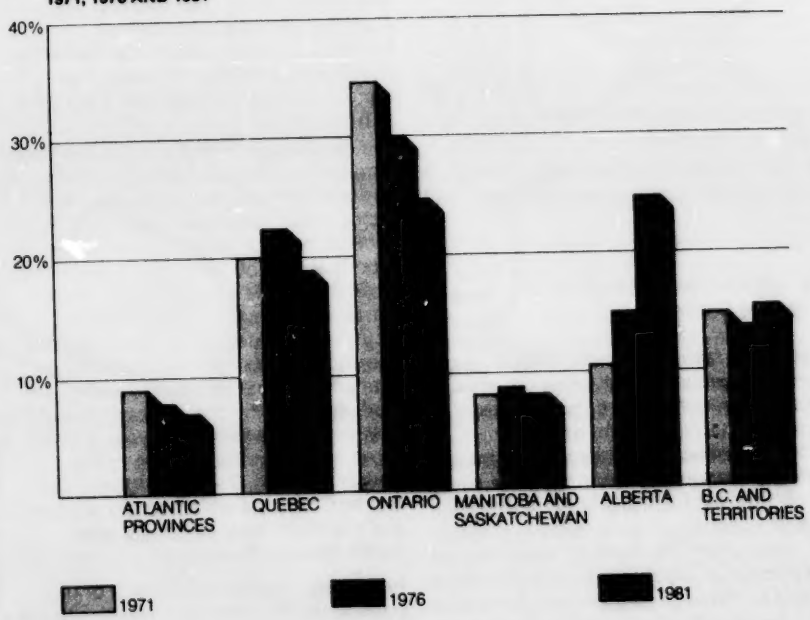
Region	Percentage of Canadian Total			Estimated Increase (%) 1971-1981 (in 1971 dollars[1])
	1971	1976	1981	
Canada	100.0	100.0	100.0	36.3
Nfld.	3.4	2.2	2.0	– 25.1
P.E.I.	0.4	0.3	0.3	4.4
N.S.	3.0	2.6	2.9	25.8
N.B.	2.2	2.7	1.9	10.7
Que.	20.8	23.9	19.1	21.7
Ont.	35.9	30.4	24.6	1.0
Man.	4.5	3.9	2.7	– 22.9
Sask.	3.3	4.3	5.2	102.8
Alta.	11.3	15.7	25.0	187.1
B.C.[2]	15.2	14.0	16.3	46.5

SOURCES: *Construction in Canada*, Statistics Canada, publication no. 64-201, 1980–1982, and *Construction Price Statistics*, Statistics Canada, publication no. 62-007.

[1] The estimates in this column are approximations. Price indices are published only by regions, and various assumptions underline the calculation of price deflators. The increase (or decrease) is also affected by chance factors: the level of construction in a particular province may have been accidentally higher or lower in the years compared.

[2] Includes Yukon and the Northwest Territories.

PERCENTAGE SHARES OF CONSTRUCTION PROGRAMS 1971, 1976 AND 1981



5.1.3 The Geographic Distribution

The geographic distribution of construction activity has also undergone major changes. The shift has been clearly from the East and central Canada to the West (see Table 5.3). Between 1971 and 1981, the percentage of the total value of construction work performed in the Atlantic provinces decreased from 9 per cent to 7 per cent and in Ontario from 36 per cent to 25 per cent. Quebec and Manitoba also experienced reductions. The corresponding increase has gone almost entirely to Alberta (to 25 per cent from 11 per cent) and partly to Saskatchewan and British Columbia.

Major differences can be seen in construction activity in each province during the decade. In constant (1971) dollars, the total value of construction work performed in two provinces (Newfoundland and Manitoba) decreased by more than 20 per cent. It increased tremendously in Alberta (187 per cent), Saskatchewan (103 per cent), and British Columbia (47 per cent); increased moderately in Nova Scotia (25 per cent), Quebec (22 per cent) and New Brunswick (11 per cent); and remained rather stable in Prince Edward Island (4 per cent) and Ontario (1 per cent).

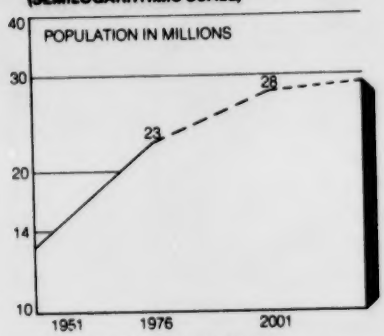
Thus the two main shifts that have occurred in the late 1970s were the following: a shift from residential to engineering construction, which started in 1978, and a movement from eastern and central Canada to the west, which started even earlier.

Subsequently, the 1982-1983 recession has reduced construction activities in all sectors.

5.2 Forecasting Construction: The Context

Two basic factors determine the level of construction activity: the demographic situation, which bears directly on residential construction and on certain other infrastructure projects, and the general economic situation, which affects industrial projects more directly.

ACTUAL AND PROJECTED GROWTH OF CANADIAN POPULATION 1951-1976-2001 . . . (SEMILOGARITHMIC SCALE)



1951–1976 TOTAL INCREASE: 64%
ANNUAL GROWTH RATE: 2.0%

1976–2001 TOTAL INCREASE: 22%
ANNUAL GROWTH RATE: 0.8%

5.2.1 Demographic Factors

The Canadian population is now growing at a much slower pace than before and is becoming correspondingly older (see Figure). From 1951 to 1976, the Canadian population increased by 64 per cent (14 million to 23 million), which implies an average rate of growth of 2 per cent a year. In the last quarter of the century, from 1976 to 2001, the Canadian population will likely increase by only 22 per cent, one-third the rate of the previous quarter century, or an annual increase of less than 1 per cent (0.8 per cent).

The geographic distribution of the future population is somewhat more difficult to forecast because of an unpredictable factor, interprovincial migration. If the general trend of recent years continues, Alberta would be the biggest winner of all (although the economic downturn caused a reversal in 1983); Ontario would come close to the Canadian average and keep its numerical advantage over all the other provinces, while Quebec would be the big loser, growing at less than 0.2 per cent a year. If interprovincial migrations return to their long-term trend, Ontario, Alberta, and British Columbia would be the winners, and the Maritimes, Manitoba, and Saskatchewan the losers.

Regarding the age distribution of the population, an important increase in the percentage that are elderly is a certainty. For instance, the 65-and-over group, which now accounts for a little more than 9 per cent of the Canadian population, will certainly represent 11 per cent or more of the Canadian population in 1990. Except for Prince Edward Island, this group of elderly citizens will grow appreciably in all provinces; in Manitoba and British Columbia, it might reach close to 13 per cent of the total population.

5.2.2 Economic Factors

Industrial projects are more directly affected than infrastructure projects by basic economic factors: the level of inflation, interest rates, political stability or instability, the state of the economy around the world, oil prices, and a volatile factor called expectations. All these will be reflected in the forecast.

5.2.3 Assumptions

The following forecast is based on a set of assumptions that could be considered relatively conservative in the short run but fairly optimistic in the long run. These assumptions are as follows.

1. The United States recovery will be moderately strong through to the mid-1980s but will be slow throughout the latter half of the decade.
2. Inflation will range from 5 per cent to 7 per cent throughout the decade.
3. Real interest rates will continue to be abnormally high (5 per cent or more).
4. The nominal price of crude oil will firm up and increase slowly over the long term.
5. There will be a modest development of Canada's energy resources.

5.3 The Outlook for Industrial Projects

5.3.1 The Effect of the Recession

There was a considerable deterioration of Canada's economic performance through 1982, driven primarily by a strong downturn in business capital investment. Reduced expenditures, particularly in the primary and manufacturing categories, resulted in an overall decline of over 6 per cent compared to 1981 (see Table 5.4).

The recession in the industrialized nations has led to significant reductions in demand for raw resources and a softening of commodity prices. Construction outlays by Canada's hard-hit primary industries declined by 12 per cent

TABLE 5.4

NEW CONSTRUCTION ACTIVITY BY CATEGORY, CANADA, 1981-1991

Category	Value (millions of 1981 dollars)				
	1981	1982	1985	1988	1991
Primary	8,533	7,509	9,063	10,963	12,391
Manufacturing	3,074	2,561	3,181	3,596	4,337
Utilities (Energy Generation)	5,393	5,884	6,589	7,457	9,215
Industrial projects	17,000	15,954	18,833	22,016	25,940
Transportation	2,575	3,108	2,567	2,139	1,853
Communications	1,124	982	978	1,046	1,220
Finance & real estate	3,917	3,134	3,066	3,092	3,679
Trade	593	495	506	628	685
Commercial services	718	712	534	981	1,050
Institutions	1,859	1,933	2,351	1,792	1,924
Government	5,827	6,203	7,045	7,298	7,975
Housing	13,135	9,575	11,294	11,286	11,399
Infrastructure projects	29,799	26,142	28,341	28,242	29,785
Total	46,788	42,096	47,174	50,258	55,725

Category	Percentage Change (1981 dollars)			
	1981-82	1983-85	1986-88	1989-91
Primary	– 12.0	6.5	6.5	4.2
Manufacturing	– 16.7	7.5	4.2	6.4
Utilities	9.1	3.8	4.2	7.3
Industrial projects	– 6.1	5.7	5.3	5.6
Transportation	20.7	– 5.9	– 5.9	– 4.7
Communications	– 12.6	– 0.1	2.3	5.3
Finance & real estate	– 20.7	– 0.8	0.3	6.0
Trade	– 16.5	0.7	7.4	2.9
Commercial services	– 0.8	– 9.2	21.6	3.0
Institutions	4.0	6.8	– 8.7	2.4
Government	5.9	4.3	1.2	3.0
Housing	– 27.1	5.7	0.0	0.3
Infrastructure projects	– 12.3	2.7	– 0.1	1.8
Total	– 6.0	3.8	2.1	3.5

Category	Percentage Composition				
	1981	1982	1985	1988	1991
Primary	18.2	17.8	19.2	21.8	22.2
Manufacturing	6.6	6.1	6.7	7.2	7.8
Utilities	11.5	14.0	14.0	14.8	16.5
Industrial projects	36.3	37.9	39.9	43.8	46.6
Transportation	5.5	7.4	5.4	4.3	3.3
Communications	2.4	2.3	2.1	2.1	2.2
Finance & real estate	8.4	7.4	6.5	6.2	6.6
Trade	1.3	1.2	1.1	1.2	1.2
Commercial services	1.5	1.7	1.1	1.9	1.9
Institutions	4.0	4.6	5.0	3.6	3.5
Government	12.5	14.7	14.9	14.5	14.3
Housing	28.1	22.7	23.9	24.5	20.5
Infrastructure projects	63.7	62.1	60.1	56.2	53.4
Total	100.0	100.0	100.0	100.0	100.0

SOURCE: Based on projections prepared by Informetrica Ltd., 1983.

in 1982. The major decline in investment by the manufacturing sector (about 17 per cent) was due to the drop in consumption expenditures, specifically durables, and the severe downturn in the new housing market. All of these factors were compounded by the extremely high interest rates over the 1981-1982 period.

5.3.2 The Short-term Outlook: Slow Recovery

Capital investment is expected to have declined further in 1983. It is projected that recovery in 1984 and 1985 will be strong and that construction investment by business will reach 1981 levels by 1985.

This projected slow recovery has a number of implications for shifts in types of construction activity. Although it is not expected that there will be a significant shift in the first half of the decade in the percentage of building versus engineering construction, adjustments are expected to occur within each of these categories.

The most notable adjustments are projected in engineering construction. The construction of mining facilities and oil and gas projects is forecast to decrease in relative importance in the first half of the 1980s. The contribution of electric power facilities is forecast to remain stable.

5.3.3 The Longer-term Outlook: Strong Development

It is expected that construction activity on industrial projects, stimulated by resource development, will be stronger throughout the latter half of the decade, recording real increases of over 5 per cent annually. The expected increase in investment by primary industries will provide a stimulus to the manufacturing sector (Table 5.4). Construction investment by manufacturing industries is projected to be quite strong during the last half of the 1980s. Another growth factor is related to the expectation that a further series of major electric power projects will then be viable. In summary, industrial projects are expected to lead the way in the achievement of larger construction programs in that period.

5.4 The Outlook for Infrastructure Projects

5.4.1 Residential Construction

5.4.1.1 Determining Factors

The dominant factor that determines the changes in the housing stock is household formation, which in turn depends on the natural growth of population, net external migration, age distribution, etc. The most important component of household formation is family household formation, since it presents the bulk of the demand at any given time and is also very inelastic. On the other hand, non-family household formation is far more elastic, for it is a function of income level and individuals' expectations.

Housing requirements will decrease for the rest of the century. Because all figures are derived from the propensities of the population already in existence in Canada, they are very reliable as predictors. Possible deviations exist only in dramatic changes in the propensity to form a household and in the net external migration level. The probability of such deviations from the present trends is quite small.

The housing requirements are met in two ways: new construction and renovation or conversion of the existing housing stock. The ratio between the two will change considerably, and the effect of this change on the industry will be felt strongly. These two components of residential construction will be considered in sequence.

5.4.1.2 New Dwelling Units

It is estimated that for the next five-year period, about 130 000 new family households will be formed annually. Non-family household formation depends on the economic climate of the period. Non-family household formation dropped during recent years from the levels of the mid-1970s. Currently it is probably at a level of about 60 000 a year. Consequently, one can argue that annual housing requirements are now approximately 190 000. However, for the next five years, this figure will likely slide gradually to about 170 000 a year.

Dwelling starts in the mid-1970s were around 250 000 per year; hence the result is that the construction of new dwelling units will decline during the rest of the current decade substantially below the record level of past years (see Figure).

This decline will not be felt evenly in the various provinces. In the first half of the decade, the effect of the economic slowdown will be negative everywhere. In the second half, a slow increase will likely occur in Quebec and Ontario, but all other Canadian provinces are expected to experience a decline in expenditures on new housing.

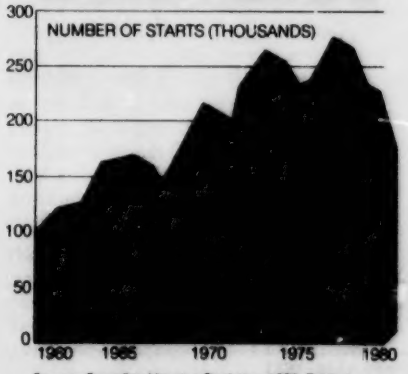
5.4.1.3 The Adaptation of the Existing Housing Stock

The net annual increase in Canada's housing stock has been about 2 per cent. With the future decline in new residential construction, it is obvious that because of the durability of the existing housing stock, it will have to serve changing households.

Although it is expected that the average size of the household, which experienced a dramatic decline during the past 30 years, will not decline much further, the housing units that now exist will have to be kept up to date. In cases where it is feasible, dwellings will be renovated or converted into more units.

Energy considerations will likely contribute to this trend. Urban sprawl calls not only for additional municipal services, such as roads, water and sewer lines, lighting, and snow removal, but also for increased use of energy for transportation. The movement of population to the suburbs has been reversed during the past few years. Renovations will no doubt pick up substantially in the near future and will represent proportionately larger expenditures in the domain of residential construction.

DWELLING STARTS IN CANADA, 1960-1980



Source: Canadian Housing Statistics, 1980, Table 1.

Renovation activities already represent a market of over $6 billion a year in Canada. Renovation's share of total expenditures on housing has jumped from 29 per cent to 38 per cent over the past five years.

5.4.1.4 The Effect on the Industry

The residential construction sector will undergo substantial changes in the decade ahead. Up to now, a typical builder played three different roles: he was a land developer, a marketing entrepreneur, and a construction manager. The first role has for many builders all but disappeared because land was overstocked; the other two roles will need to readjust in many ways.

With the expected decline in requirements for new housing, the residential construction industry will have to concentrate to a greater extent on renovations, alterations, and conversions. This change implies a considerable problem of adaptation for the industry, which will not be achieved without strains. To give but one example: the average size of firms engaged in residential construction is likely to decrease because smaller firms are more efficient at custom building and renovation than large house-building enterprises.

The role of governments will continue: to promote and facilitate private enterprise, mostly with new financing instruments and new types of insurance, possibly also covering the borrower. Direct intervention will be needed in the area of subsidies for people in lower income brackets.

5.4.2 Public Works

Demographics also strongly influence many other categories of infrastructure project. Institutional construction projects are forecast to decline slightly in total value. The provision of educational buildings is a leading example in this regard. The construction of roads, sewer and water installations, and railroads is expected to increase in importance, but only marginally. Continued budget restraints will likely be another significant factor causing the expected overall construction outlays by governments to not increase significantly, notwithstanding the launching of special public works programs designed to foster economic recovery.

5.4.3 The Business Sector

Capital investment by the trade, finance, and commercial services sector declined dramatically in 1982 and is expected to decline further in 1983. The projected recovery is very slow, and the 1981 level is not expected to be reached until 1987. Slow growth is also expected for the balance of the decade.

5.5 Summary and Implications

5.5.1 The General Outlook

Forecasting can be perilous. The experience of the two years since 1981 has shown dramatically how widely accepted assumptions can fail to materialize. If the present econometric projections for larger construction programs come to pass or are exceeded, the construction industry will have to gear up again for them and also for a larger number of major projects within them. If the projections are not realized, Canada's future competitiveness will be in further jeopardy.

Either way, the construction industry will be called upon to improve its performance. In a rising market, the industry must meet the challenge of executing larger programs and projects efficiently. In a declining market, it must also increase its efficiency to help stimulate investment in capital projects.

In summary, the general outlook for the end of the decade is for the continued decline of the relative importance of the residential construction sector to some 20 per cent of the total construction program (see Figure). The main upwards shift, particularly in the latter half of the decade, is projected to continue to favour industrial projects such as electric power generating stations and industrial buildings. Engineering construction will rise to more than half of the total construction program.

Geographical shifts will also continue, but at a much slower pace (see Figure). Alberta, British Columbia, Yukon, and the Northwest Territories, which accounted for 26.5 per cent of total construction in Canada in 1971, are expected to represent almost 45 per cent by 1990.[1] The share of all other provinces but Newfoundland and Ontario will decline marginally by the end of the decade. Newfoundland's share is expected to increase because of the development of its offshore resources, and Ontario is projected to regain some of its previously lost share.

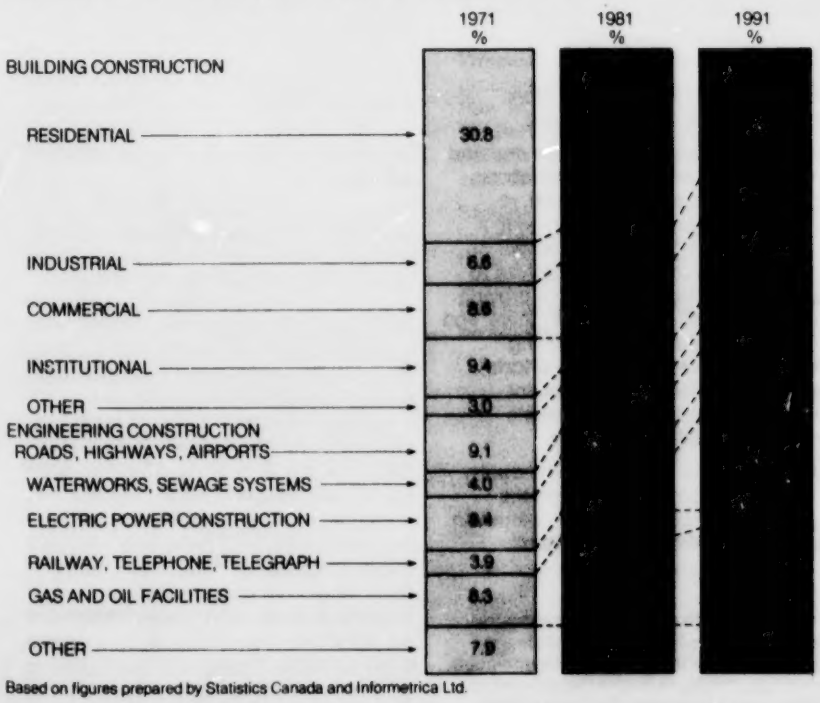
The above major shifts will entail other changes. For example, the size of construction firms could change in opposite directions in different sectors. The average size of construction firms in the residential sector is likely to decline, mainly because of the decreasing importance of speculative construction and the role of the builder, together with the increase in renovation and conversion activities. On the other hand, energy-related projects will be undertaken more and more by larger firms and joint ventures bringing together contractors of international stature.

5.5.2 Training

The above changes in turn have important implications for the training programs of construction industry personnel. Two years ago, there were serious shortages of certain skills. For example, at the trade level, there were shortages of the skills of pipefitters, plumbers, welders, electricians, millwrights, and heavy equipment operators, particularly in some sections of the country. Experienced supervisory, engineering, and management personnel were also in short supply.

However, the recession has led not only to a general surplus but also to a serious loss in the construction industry's human resources at all levels to other industries and to other countries. It is in the national interest to have construction volumes that will prevent a further erosion of the construction industry's vital resources.

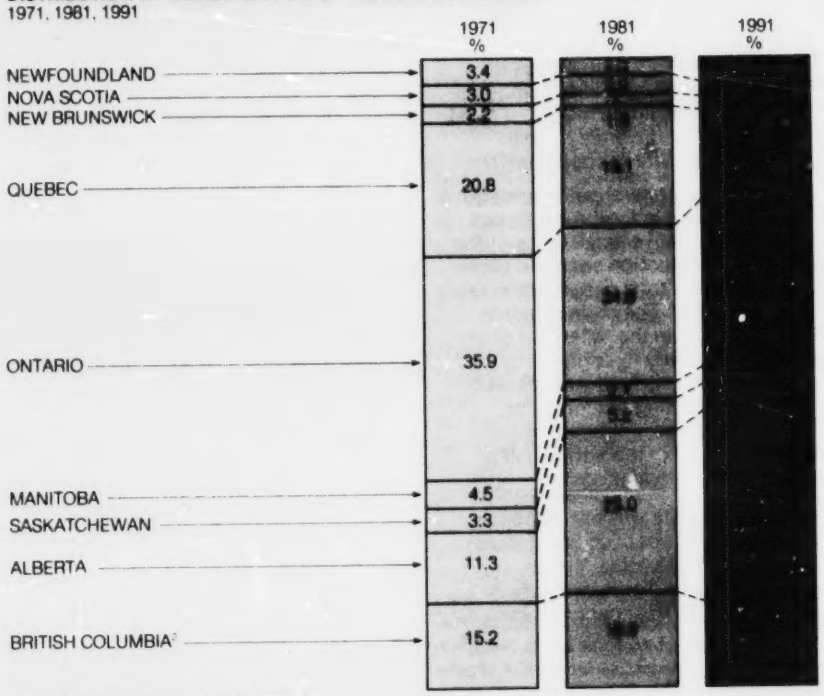
DISTRIBUTION OF CONSTRUCTION BY TYPE, CANADA, 1971, 1981, 1991



Based on figures prepared by Statistics Canada and Informetrica Ltd.

[1] Figures for British Columbia include data for the two territories.

DISTRIBUTION OF CONSTRUCTION BY PROVINCE[1], CANADA,
1971, 1981, 1991



[1] P.E.I. share is respectively 0.4, 0.3 and 0.3
[2] Includes Yukon and the Northwest Territories, which in 1981 accounted for about 2% of total construction activity

One safe prediction is that there will again be serious shortages as construction activity attains previous levels. It is therefore vital that training and retraining programs be launched during the present breathing spell to meet future needs. This is especially necessary with regard to programs that last for several years. Unfortunately, registrations have decreased, and educational institutions have suffered budget cuts leading to the loss of teaching staff and to a reduction in courses being offered. In short, those who are not entering training now will not be graduating in 1986-1988, when the demand for services of trained personnel is likely to be high. (See also section 6.4.4.)

The emphasis on industrial projects in the projections for the second half of the present decade points to project management being a critical ingredient. The skilled trades and engineering design professionals in short supply in recent times are also especially involved in this category of construction work. The increased importance of housing renovation and retrofit will mean that this sector will be somewhat more labour intensive than in the past.

The discrepancies between the demand for and supply of construction labour, whether shortages or surpluses, regional or structural, have long been a matter of major concern. A number of organizations have taken initiatives to develop projections that would provide guidance on the composition, scale, and timing of recruitment and training programs.[2] Several extensive efforts were made by federal government departments to develop a suitable system on a nationwide basis.

During 1982, the Construction Industry Development Council reviewed the objectives and concepts of a "Canadian Occupational Projection System" (COPS) proposed by Employment and Immigration Canada. The COPS plan incorporates analysis of the prospects for labour supply and demand by occupation, broken down by regional and industrial sector, with a view to the development of a realistic and effective training system. The CIDC registered its strong support and recommended that the construction industry be accorded priority status in the selection of the initial group of industries to receive trend analyses. The desirability of consultation with representatives of users in the construction industry about the design and operation of the system was also stressed.

Construction was indeed selected for early and specialized consideration, and a submodel is being developed. The value of data contemplated to be available under the COPS program is of growing urgency. The completion and refinement of this project and its widening application to construction training programs are therefore eagerly awaited.

5.5.3 Construction Exports

It is estimated that the net trade balance of the construction industry is already favourable: an excess of exports over imports of over $1 billion a year. The recession in Canada and attendant decreasing domestic markets will likely have a strong positive effect in increasing the effort made by members of the construction industry to secure foreign business.

Twenty per cent of the billings of Canadian consulting engineers are related to foreign projects, and several firms have attained world-class ranking. A major share of the operations of Canadian developers is located in the United States market. The redevelopment of its urban cores promises to provide even further scope for the application of expertise. Canadian developers are also looking increasingly at the potential in other countries. Manufacturers of certain construction materials, capital equipment, prefabricated components and structures, etc., are active in export trade. A number of contractors, architects, and other members of the industry are also working on foreign projects.

[2] These include the Construction Industry Advisory Council of British Columbia, the Canadata Division of Southam Communications Ltd., the Nova Scotia Department of Labour and Manpower, the Owner-Client Council of Ontario, and the CIDC Task Force on Demand Forecasting.

Other countries have also experienced a decline in domestic construction; so members of their construction industries have similarly looked to the export market as a means of retaining or increasing their volumes of work. On the other hand, many of the developing countries have experienced serious revenue reductions and therefore have had to curtail the volume of their capital investment projects. Their own construction industries are increasing in expertise and capacity. The combination of such factors means that international competition will become more intense.

The implications for efforts to maintain and increase Canadian construction exports still further are clear. To compete successfully, Canadian firms must have an effective commercial intelligence system and adapt to foreign conditions. For example, the desire of many foreign owners to award turnkey contracts for their projects will require the grouping of Canadian design professionals, manufacturers, and contractors to submit combined proposals. Similarly, a shift on overseas work to industrial projects from infrastructure projects will necessitate greater emphasis on leading-edge process technology. It will be essential that the arrangements for financing and risk insurance available to Canadian enterprises be competitive with those available to members of the construction industry of other nations.

5.5.4 Statistical Coverage

Construction activities are so diverse, widespread, and dynamic that they pose for statisticians particular problems of definition, coverage, collection, and development. This work also requires considerable resources. Substantial advances have been made, but the quantity and quality of construction statistics in general do not compare favourably with those available for many other economic sectors. The statistical coverage of residential construction is the most extensive of the various construction sectors because of the strong socio-economic and political interests related to it.

The CIDC Construction Statistics Committee was pleased to respond to a request from Statistics Canada to assist in the latest revision of the Standard Industrial Classification (SIC). Subsequently a joint meeting was held with officials from a number of Statistics Canada divisions to review their principal series relating to construction with a view to obtaining improvements. The atmosphere at this meeting was excellent.

Historical statistics are most valuable, but there is also keen interest in the more hazardous area of forecasting. The CIDC committee selected a group of leading economic indicators relating to future construction activity, and these are published on a quarterly basis by the *Daily Commercial News* and *Construction Record*. The preparation of this chapter involved the use of such indicators and certain assumptions in an econometric model covering the next ten years. Here again, the models used to develop possible scenarios for different aspects of future construction activities need ongoing adjustments. Additional disaggregations of the data are also often desirable.

The necessity of keeping the SIC's "Division F — Construction Industries" up to date was demonstrated in the 1981 review. At that time, "Industrial Construction" was recognized in the engineering construction sector, and a separate subclassification was established for "Pipeline Construction". Whereas many of the industry's supply problems were related to these groups, they were not separately identified in the previous SIC. Accordingly, there was no appropriate statistical focus on these very sensitive areas.

Statistics Canada was most cooperative in adopting the CIDC's recommendations for revision. Increased inputs by users in the development of construction statistics in general would no doubt be equally welcome.

Recommendation 5.1 That a systems approach be adopted in the collection and publication of statistics on capital investment realizations and intentions and on the construction industry generally, including the following features:

a) The Standard Industrial Classification (SIC) should reflect the principal distinctive categories of activity in the construction industry and be adhered to in statistical series relating to volume, employment, prices, costs, etc.
b) The initial division into categories of construction projects should be that of industrial projects and infrastructure projects.
c) The statistical breakdown or coverage of construction activity should relate to current systems under which the industry operates.

Recommendation 5.2 That the Government of Canada, through its own statistical agencies and through support to those developing projections of future construction activity, achieve, in consultation with users, further improvements in the coverage, accuracy, and usefulness of construction statistics.

6 Construction Productivity

6.1 Overview

- **6.1.1** Definitions
- **6.1.2** Recent Trends
- **6.1.3** The Influence of Productivity on Costs and on Future Capital Investment Programs

6.2 The Main Factors Influencing Levels of Construction Productivity

6.3 The CIDC Survey of Canadian Construction Sectors and Buyers of Construction Services

6.4 Conclusions

- **6.4.1** The Centre for Construction Productivity
- **6.4.2** Productivity Measurement
- **6.4.3** Collective Actions
- **6.4.4** Education and Training

Annex A: CIDC Questionnaire on Factors Impairing Construction Productivity

Annex B: Organizations Participating in the CIDC Survey on Factors Impairing Construction Activity

6 Construction Productivity

6.1 Overview

6.1.1 Definitions

Improved construction productivity is a key factor in the efficiency and competitive edge at home and abroad of not only firms in the industry but also their clients.

Productivity is accordingly a major concern throughout the industry. However, productivity is affected by so many factors that it is difficult to define and difficult to measure.

The concept of productivity is consequently not always clearly understood. There also exists something of a parallel with Mark Twain's observation that whereas everybody talks about the weather, nobody does anything about it. Fortunately, there has recently not only been more talk about the need to improve construction productivity but also a growing will to "do something about it".

Often there are problems in definition because "productivity" means different things to different people. Economists regard it as the ratio between total inputs of resources and output. These inputs include labour, materials, equipment, management expertise, and technological improvements. Inasmuch as the output of the construction industry is so diversified, the only aggregate measurement is the dollar value of construction put in place. Within the total, functional units such as square metres of building or kilometres of road may be used to measure the output of specific types of project.

Productivity is frequently measured in terms of labour input because man-hour statistics are relatively easy to obtain and because the construction industry is labour intensive. Also, the quality of labour required is more flexible than the quantity of capital or materials. It should be remembered in such cases that both labour productivity and the effectiveness of the whole system in converting various factors of production into the finished construction project are being measured.

Construction practitioners naturally tend to be more concerned about the time spent completing standard construction tasks than about macro measurements for an entire segment of the industry. In construction, references to "productivity" are often closely akin to those of efficiency or cost effectiveness.

Having defined productivity, there remains the problem of measuring it. Even standard designs must be adapted to fit the site and are subject to the additional variables of seasonality and distance from sources of supply. True comparisons may therefore be difficult to achieve.

But if there are difficulties of definition and measurement, there can be no doubt about the effect of productivity on the cost and duration of construction projects! Productivity may be an intangible cost factor, but its increases or decreases have a very tangible effect on overall construction costs and performance.

6.1.2 Recent Trends

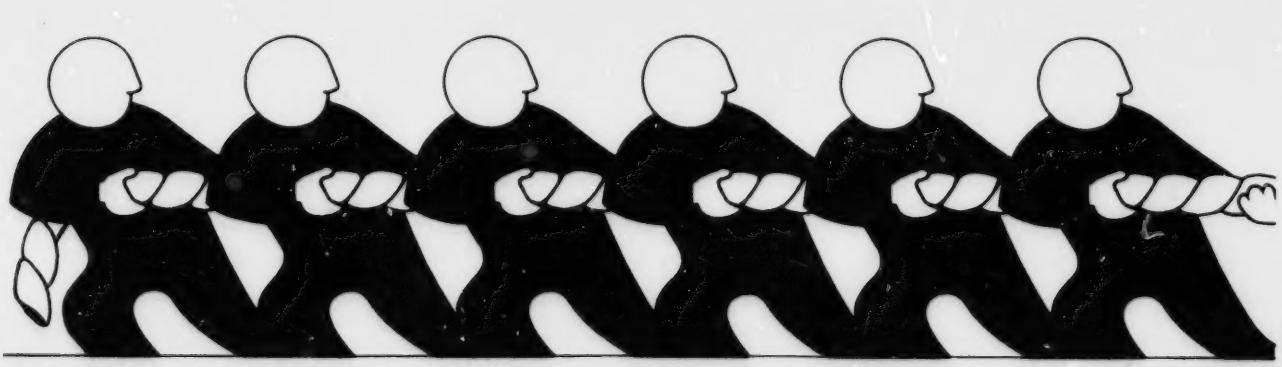
During the past twenty-five years, there have been important advances in the average level of productivity in the Canadian construction program. Within the total, there have been significant variations, depending upon the nature of the work and particular conditions relating to the individual project. (See chapter eight, section 8.2.1, for some examples.)

In general, productivity levels have been relatively high in residential building projects. Contributing factors include the repetitive nature of most of the work; the relative ease with which the work may be supervised; the ability of the individual to see how his work fits into the whole project; and a high level of motivation among on-site personnel to complete their portion of the work quickly.

Civil engineering work has particularly benefited from the introduction of larger and more efficient units of construction equipment.

The picture on larger buildings and mega projects is less bright. Improve-

PRODUCTIVITY IS A TEAM EFFORT



ments in productivity may have been offset to a greater degree by the custom nature of such projects, their increased complexity (especially with respect to their mechanical and electrical components), and their large-scale nature. The mammoth size of major projects has a tendency to beget delays, shortages, and problems of supervision. These factors may be exacerbated by remote locations and type of contract.

Moreover, in recent years there has been a general reduction in the growth rate of productivity in most sectors of the Canadian economy. Construction has shared in this experience. Concern about productivity levels — particularly when there has been a decline — has been accentuated by high rates of inflation and interest. A new awareness of and concern about construction productivity have accordingly been expressed by construction practitioners and the buyers of construction services alike.

The overall reduction in construction activities in the early 1980s has been conducive to improved productivity in the short term because of the motivation of all concerned to increase efficiency. This trend, however, is not without its negative aspect. For example, a good many experienced construction personnel may be permanently lost to the industry and may not be available when the tempo of construction activity increases. This is another example of the problems related to the cyclical nature of construction activity: productivity also suffers in the event of extreme swings to boom or bust.

6.1.3 The Influence of Productivity on Costs and on Future Capital Investment Programs

Increasing productivity in the construction sector must be a compelling, ongoing goal. For instance, the direct relationship between productivity and construction costs will in turn have a vital bearing on future capital investment decisions. Also, the prospects of increasingly complex and larger projects in the years ahead call for special efforts to overcome the factors that have impaired construction productivity in the past.

The stakes are high. A reduction of a few per cent in productivity on a major project means many millions of dollars in extra costs. The same situation applies to other projects when viewed in the aggregate — in this case, a reduction in productivity of a few per cent costs well over a *billion* dollars a year. Conversely, the improvement of productivity will mean commensurate savings or will at least work to offset inflationary trends.

6.2 The Main Factors Influencing Levels of Construction Productivity

It has been generally recognized that the level of construction productivity is affected by many factors. These include
- the calibre of the design and working drawings
- the type, size, location, and scheduling of the project
- the contractor's organization
- the availability of suitable labour, materials, and equipment
- the speed of the decision-making process regarding permits, changes, and extras
- the degree of motivation and cooperation among those engaged on the project
- the advancement of technology
- the level of safety.

Construction practitioners and buyers of construction services commonly hold strong opinions about the principal factors that improve or impair the levels of construction productivity. These opinions, however, often vary widely. The CIDC study group with responsibility for identifying the main factors influencing construction productivity concluded that it should endeavour to obtain a widespread, representative consensus on the subject from knowledgeable owners; architects and consulting engineers; general, specialty, and trade contractors; developers and builders; labour union officials; manufacturers and suppliers; cost consultants; etc.

A questionnaire that sought to obtain a ranking within and between major categories of factors was prepared. The respondents were requested to provide basic information about their own organization, volume, and project types and then to select, where relevant, the most important factors, listed under the following seven categories.

1. *Project Conditions* — Sixteen factors were listed, including remote location, very large-scale project leading to communication and motivation problems, difficult working conditions because of climate or topography, use of fast-tracking, and the project's technological complexity.
2. *Market Conditions* — Seven factors were listed, including overtime required as an inducement because of competition from other projects, cost-plus contracts, and lack of experienced personnel.
3. *Design and Procurement* — Sixteen factors were listed, including poor quality of drawings and specifications, insufficient attention to constructibility of design, a large number of changes in design requiring change orders or rework or both, inadequate or overzealous inspection during the procurement phase, and poor work packaging.
4. *Management of the Construction Phase* — Twenty-six factors were listed, including inadequate use of planning and scheduling techniques, inadequate manpower levelling, lack of speedy feedback and initiation of corrective action, poor coordination among contractors, insufficient supervisory personnel, and excessive use of overtime.
5. *Labour* — Fourteen factors were listed, including union rules being too restrictive, jurisdictional disputes, inadequate instruction regarding tasks and project goals, absenteeism, and use of prefabrication restricted by collective agreement.
6. *Government Policy and Regulations* — Nine factors were listed, including environmental regulations, mobility restrictions, and lack of speedy approval and issuance of permits.
7. *Education and Training* — Seven factors were listed, including lack of appropriate training programs for skilled tradesmen, supervisory, and project management personnel, lack of effective safety programs, and ineffective technology transfer programs and media.

The questionnaire requested respondents to rank the most important factors impairing productivity in each category and then to rank the seven categories in order of importance.

TABLE 6.1

RANKING OF MAJOR FACTOR CATEGORIES
IMPAIRING CONSTRUCTION PRODUCTIVITY

General Contractors		Trade Contractors		Owners		Labour Union Officials	
Categories in Order of Significance	Rank Factor	Categories in Order of Significance	Rank Factor	Categories in Order of Significance	Rank Factor	Categories in Order of Significance	Rank Factor
1 - Labour	1.98	1 - Labour	2.17	1 - Design & procurement	1.86	1 - Design & procurement	1.85
2 - Project conditions	1.77	2 - Management of construction phase	1.78	2 - Management of construction phase	1.80	2 - Management of construction phase	1.81
3 - Management of construction phase	1.73	3 - Project conditions	1.71	3 - Project conditions	1.64	3 - Project conditions	1.74
4 - Design & procurement	1.45	4 - Design & procurement	1.51	4 - Labour	1.50	4 - Market conditions	1.30
5 - Market conditions	1.30	5 - Market conditions	1.15	5 - Government policy & regulations	1.30	5 - Government policy & regulations	1.30
6 - Government policy & regulations	0.94	6 - Education & training	0.85	6 - Market conditions	1.19	6 - Labour	1.01
7 - Education & training	0.83	7 - Government policy & regulations	0.83	7 - Education & training	0.71	7 - Education & training	0.99

TABLE 6.2

RANKING BY GROUPS OF THE MOST PREVALENT FACTORS OF HIGH IMPORTANCE
IMPAIRING CONSTRUCTION PRODUCTIVITY

General Contractors	Trade Contractors	Owners	Labour Union Officials
1 - Union rules too restrictive	1 - Union rules too restrictive	1 - Large number of design changes requiring change orders and/or rework	1 - Large number of design changes requiring change orders and/or rework
2 - Lack of experienced tradesmen	2 - Labour opposed to productivity improvement efforts	2 - Poor quality of drawings and specifications	2 - Insufficient expediting of major equipment and material purchases
3 - Labour opposed to productivity improvement efforts	3 - Lack of motivation	3 - Insufficient expediting of major equipment and material purchases	3 - Ineffective communications between owners, designers, contractors, suppliers, labour
4 - High seasonal variability in weather	4 - Training of tradesmen inadequate	4 - Inadequate use of planning and scheduling techniques	4 - Inadequate use of planning and scheduling techniques
5 - Training of tradesmen inadequate	5 - Lack of experienced tradesmen	5 - Union rules too restrictive	5 - Insufficient consideration of construction safety in design detailing
6 - Jurisdictional disputes	6 - Ineffective communications between owners, designers, contractors, suppliers, labour	6 - Ineffective communications between owners, designers, contractors, suppliers, labour	6 - Poor coordination among contractors
7 - Lack of motivation	7 - Poor coordination between contractors	7 - Insufficient attention to constructibility of the design	7 - Poor quality of drawings and specifications
8 - Supervisory personnel lack sufficient management training	8 - Poor quality of drawings and specifications	8 - Inadequate planning and scheduling of procurement processes	8 - Inadequate planning and scheduling of procurement processes
9 - Indecisive owners	9 - Indecisive owners	9 - High seasonal variability in weather	9 - Material and/or equipment shortages
10 - Inadequate use of planning and scheduling techniques	10 - Slow and/or indecisive decision-making re-design details and changes	10 - Overdemanding specifications where not appropriate	10 - Very large-scale project leading to communication and motivation problems

6.3 The CIDC Survey of Canadian Construction Sectors and Buyers of Construction Services

The draft questionnaire was first tested on the CIDC's own membership. This led to some minor revisions. The distribution of the questionnaire was achieved mainly through the good offices of major national associations and their member regional groups in the construction industry, construction owners' associations, and building trades councils.

The text of the questionnaire and a list of the participating groups are included in Annex A and Annex B of this chapter.

The initial response to the questionnaire totalled 200. The various regions of the country, sectors of the industry, and sizes of firm were all represented. Included in these returns were those received from senior officers of a good many major construction companies, engineering firms, owners, labour unions, etc. The representativeness of the respondents and the combined volume of work experience represented in the replies were accordingly deemed to provide a significant sampling of opinion.

A twenty-page preliminary report was prepared by Messrs. N. Bekhit and G. Bourassa, graduate students at the Centre for Building Studies, Concordia University. In the report, responses are summarized, and the methodology used in the analysis is described. A remarkable degree of agreement among respondents about the most significant factors impairing productivity was reported.

In Tables 6.1 and 6.2 are data on the rankings given by owners, general contractors, trade contractors, and labour union officials. In this compilation, the "general contractors" also included specialty civil contractors, and EPC contractors and developers.

Table 6.1 is a tabulation of the responses given to Section D of the questionnaire, which asked for a ranking of the seven major categories of factors that impair construction productivity. All four groups of respondents included management of the construction phase, project conditions, and design and procurement among the top four factors. Labour was chosen by three groups. It will be noted, however, that the rankings were in most cases relatively close.

ANNUAL DOLLAR VALUE OF CONSTRUCTION PUT IN PLACE BY RESPONDENTS

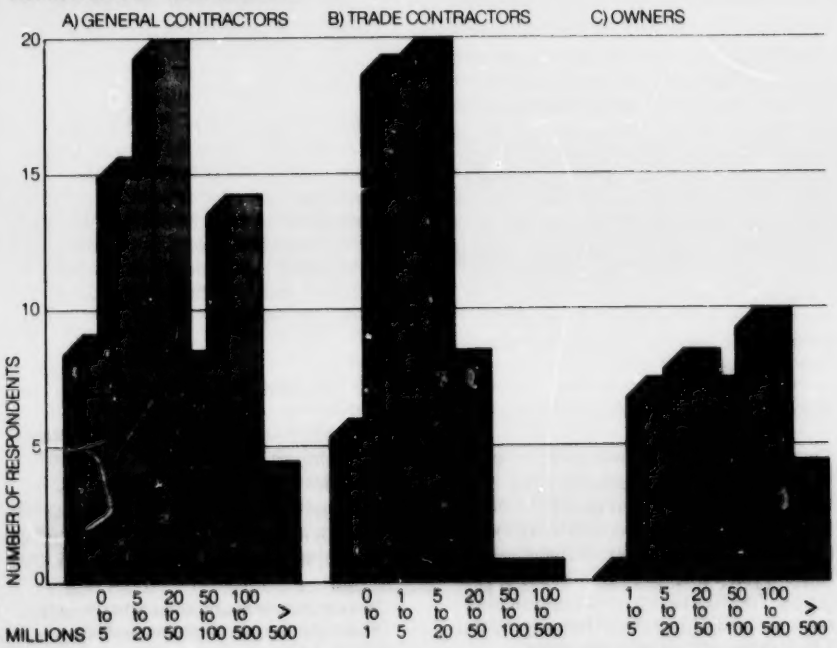


Table 6.2 is more revealing, for it lists the rankings of the most prevalent individual factors of high importance selected from among all of the categories.

Restrictive union rules were perceived by the general and trade contractors as being the most significant factor impairing construction productivity. Twenty-five follow-up telephone calls were made to obtain examples. A good many of these respondents cited provisions in collective agreements that might more properly be classified as additional cost factors than as factors that reduced productivity (for example, travel and board allowances). Also, it was widely commented that the application of restrictive union rules had eased during the past year or more because of economic conditions. However, concern was expressed that restrictive rules would return with more buoyant conditions. The comment was also made that whereas union rules had been established in the past to protect union members from exploitation, some rules now endangered union members' scope for employment.

Design change problems — that is, a large number that required change orders or rework or both — were selected by owners and labour union officials as the most serious factor impairing construction productivity.

It is significant that of the total of forty individual factors listed in Table 6.2, four were selected by three of the four groups and ten factors were selected by two of them. Only eight factors were selected by but one group. Six factors were selected mutually by the general and trade contractor groups, and the owner and labour union official groups also had six factors in common among their selections.

The factors identified by three groups as among the ten most important were

- union rules that are too restrictive
- ineffective communication among owners, designers, contractors, suppliers, and labour
- inadequate use of planning and scheduling techniques
- poor quality of drawings and specifications.

Special concerns and built-in biases may help explain why some of the selections of one group were not shared by others. Many factors were commonly

TABLE 6.3
FACTORS SERIOUSLY IMPAIRING CONSTRUCTION PRODUCTIVITY

Category	Factors
1. Project conditions	1.5 High seasonal variability in weather
2. Market conditions	2.5 Material and/or equipment shortages
	2.6 Lack of experienced design and/or project management personnel
3. Design & procurement	3.6 Large number of design changes requiring change orders and/or rework
4. Management of construction phase	4.12 Ineffective communications among owners, designers, contractors, suppliers, labour
	4.1 Inadequate use of planning and scheduling techniques
	4.16 Lack of sufficient management training for supervisory personnel
5. Labour	5.1 Union rules that are too restrictive
6. Government policy & regulations	6.3 Lack of speedy approvals and issuance of permits
	6.8 Poor timing of public sector vs. private sector projects
7. Education & training	7.2 Lack of management training programs for supervisory personnel
	7.3 Lack of appropriate management programs for project management personnel

identified, however, thereby indicating good potential areas for follow-up work.

In Table 6.3 are listed the factors in each major category about which there was a strong consensus among the survey participants generally that the factors seriously impaired construction productivity.

It should be stressed that the analysis of the survey results is truly preliminary and that substantially more detailed work will be necessary. However, it is believed that the survey accomplished its objective of identifying a wide consensus on the primary factors that impair or improve construction productivity. This identification in turn indicates the more productive areas to which further efforts should be devoted.

The survey also confirmed the widespread interest in improving construction productivity to reduce costs and to help generate new capital investment projects.

The CIDC is committed to expanding its own work program on construction productivity. Initial activities will include a follow-up on the survey returns to obtain examples of some of the principal factors cited as impairing productivity. The survey data have been computerized so that analysis by regions, scale of operations, project type, etc., may be readily conducted. The use of a semi-Delphi Technique is contemplated: respondents will be asked to respond once again, having seen the results of the main survey.

6.4 Conclusions

Obviously the substantive improvement of construction productivity is no easy or short-term task. The goal is in the best interests of all groups involved in the construction process and will require joint efforts to achieve real progress. The following conclusions and recommendations are offered to stimulate further action and progress.

6.4.1 The Centre for Construction Productivity

The survey confirmed the need for a comprehensive, ongoing effort to expand the knowledge base necessary for the improvement of construction productivity. The study group concluded early that a special centre, at which a full-time staff could devote itself to this end, should be established. The subsequent publication by the U.S. Business Roundtable of *A Plan for a National Construction Productivity Center* lent further credence to the concept.[1] The announcement in the federal budget address in April 1983 that a national productivity centre would be established in Canada was a further indication of the desirability of directing concentrated attention to productivity improvement.

It is believed that a centre for construction productivity should be a separate entity, located at an institution, such as a university, on which it could draw for specialized support. If construction is to be included in the scope of the proposed national productivity centre, construction should be accorded status as a separate sector. In either event, the construction productivity centre should have its own board of directors, composed largely of industry practitioners representing the sectors whose policies and actions influence construction productivity — design, manufacturing, management, and labour — plus owners, education, and government.

Recommendation 6.1 That a Centre for Construction Productivity be established, sponsored by industry and government, as a focal point in Canada for the collection and development of data, the identification of opportunities for improved productivity, the initiation of studies, and the dissemination of related information.

6.4.2 Productivity Measurement

Data on construction productivity must be developed on a standard basis in order that comparisons may be made from year to year, from region to region, and from organization to organization. At the present time, there is a great lack

[1] Construction Industry Cost Effectiveness Project (New York: September 1982), Report A-1.

of such information of both a micro and a macro nature. The development of data is necessary in order to evaluate progress in improving productivity.

Recommendation 6.2 That productivity data be collected by owners and contractors (or their associations) on a standard basis for selected construction tasks so that comparisons may be made over time, between regions, and with different variables.

Recommendation 6.3 That Statistics Canada be requested to develop, in consultation with the construction sector, indexes of construction productivity of a current nature for the main subsectors.

6.4.3 Collective Actions

The improvement of productivity requires deliberate action by individual organizations. However, many activities are best performed on a group basis by business associations, professional societies, and labour bodies.

Recommendation 6.4 That construction industry associations give greater attention in their programs to improving construction productivity through workshops, seminars, training courses, and special studies.

Recommendation 6.5 That the organizations representing construction employers and employees engage in joint efforts to improve productivity in recognition that this goal is in their mutual, job-creating interest.

6.4.4 Education and Training

The survey reflected the widespread opinion that under normal conditions, there is a serious lack of skilled personnel at all levels. Even in 1982, contractors cited a lack of experienced tradesmen, especially in certain trades, and insufficient management skills in supervisory personnel. On the other hand, owners, trade contractors, and labour union officials tended to identify shortcomings in project management and construction management capabilities.

Although the current general reduction in the size of the construction program has led to a serious surplus of manpower, it must be remembered that there have been serious shortages of skilled personnel in the past and that undoubtedly there will be serious shortages in the future. Consideration must also be given to the levels of qualification.

A basic problem with regard to construction training and educational programs is that many take quite lengthy periods to complete. In times of reduced construction activity, graduates encounter difficulty in obtaining employment, and this situation discourages others from entering apprenticeship, technician, or professional training programs. At the other extreme, when the industry is busy, there is a reduced incentive to take time off to obtain further training, and employers will employ those who may not be properly trained.

Ideally, it is in the slack time that special efforts should be devoted to improving skills at all levels through training and retraining programs. Such programs, whether short or lengthy, specialized or general, should be developed in close consultation with industry practitioners. Through its individual firms and associations, the industry should also be more actively involved in the integration of new graduates into the construction work force.

See also section 5.5.2.

Recommendation 6.6 That universities, community colleges, and other educational institutions expand their curricula for courses on project management, construction management, supervisory training (for example, foremen), and apprenticeship and trade training, in consultation with the construction sector and the Canadian Construction Management Development Institute, so as to better meet the industry's needs; and that adequate funding be committed to ensure that such courses be offered on a continuing basis.

Annex A

CIDC Questionnaire on Factors Impairing Construction Productivity

A) INTRODUCTION

A CIDC Study Group on Improvement of Construction Productivity was constituted to identify factors that may impair construction productivity in the decade ahead and to recommend courses of action to remove or diminish these factors. As a first phase of this mandate, the study group wishes to consult with a broad spectrum of construction industry participants to see if a consensus can be achieved on the most important of these factors. This questionnaire represents a key component in this consultation process.

For the purposes of this questionnaire, a non-quantitative, project-related concept of productivity is used to facilitate judgements regarding the relative importance of various factors on productivity.

Descriptive of each activity in the processes of design and construction for a particular project is an average rate of production per unit of time. This rate is a function of resource inputs and other project- and market-related conditions. If resource inputs are allocated as planned, then the existence of factors which impact negatively on productivity will lower this average production rate and thus extend the activity duration or require the allocation of more resources if planned durations are to be met. In either case, increased costs result, as well as the possibility of project delays.

The goal of this questionnaire is to help to determine the relative significance of these factors. Factors considered relate to different phases in the project development life cycle including design, procurement, and construction and to the roles of management, labour, and government.

B) BACKGROUND INFORMATION

Ideally, the Study Group would like one questionnaire to be completed for each major project category (e.g., residential, commercial, institutional; industrial and civil engineering) identified in question B.2.1. Accordingly, three forms are enclosed. If this is not feasible, it will be assumed that the responses given in sections C and D reflect "averaged" results based on experience with the category types identified in B.2.1.

B.1 ORGANIZATION INFORMATION

B.1.1 Please check off the item that best describes the role of your firm/organization. If two or more items are appropriate, please identify them and estimate, in approximate percentage terms, the involvement in each based on annual dollar volume.

___ Owner: Type: Private ___ Public ___
___ Developer
___ Engineering Design
___ Architecture
___ Engineer/Procure/Construct/Management Services
___ Project Management Services
___ Construction Management Services
___ Project Financing
___ General Building Contractor
___ Heavy Engineering Contractor
___ Specialty Contractor or Subcontractor Type: _____
___ Design-Build Builder or Contractor
___ Construction Equipment Supplier
___ Heavy Equipment Manufacturer
___ Fabricator
___ Construction Material Supplier
___ Labour Organization
___ Construction Organization
___ Professional Society
___ Other: Please Specify _____

B.1.2 The annual dollar volume of *construction* work of the firm/organization is:

___ Not applicable
___ 0 - 1 million
___ 1 - 5 million
___ 5 - 20 million
___ 20 - 50 million
___ 50 - 100 million
___ 100 - 500 million
___ greater than 500 million

B.1.3 Please indicate the approximate number of *design or construction* man-hours employed directly by your firm/organization per year.

___ Not applicable
___ 0 - 20 000
___ 20 000 - 50 000
___ 50 000 - 100 000
___ 100 000 - 500 000
___ 500 000 - 1 000 000
___ 1 000 000 - 2 000 000
___ greater than 2 000 000

B.2 Project Information

Two tables are listed on the opposite page in order to obtain information regarding the type(s) and characteristics of projects with which your firm/organization is involved. This information will be used in analyzing the response to part C of this questionnaire.

B.2.1 Please describe in the first table the specific types of projects (e.g. office building, dam, pulp mill, etc.) undertaken by your firm/organization; their approximate average total value in 1982 dollars; and the percentage share of this work performed by your firm/organization.

B.2.2 In the table below, please indicate the most prevalent contract type (e.g. Lump Sum, unit price, cost plus a fixed fee, etc.) used for the projects identified in question B.2.1 and the regions in which they were mainly executed.

Category	Types of Projects	Average Value	Project Cost % Done by Firm
Residential/ Commercial/ Institutional	1. 2. 3.		
Industrial	1. 2. 3.		
Civil Engineering	1. 2. 3.		

B.2.3 In the table below, please indicate the most prevalent contract type (e.g. Lump sum, unit price, cost plus a fixed fee, etc.) used for the projects identified in question B.2.1 and the regions in which they were mainly executed.

Category	Contract Type	Province/Territory
Residential/ Commercial/ Institutional	1. 2. 3.	
Industrial	1. 2. 3.	
Civil Engineering	1. 2. 3.	

C) RANKING OF FACTORS IMPAIRING CONSTRUCTION PRODUCTIVITY

The following steps are suggested to expedite completion of the questionnaire.

i) For each of the seven major factor categories (Project Conditions, Market Conditions, etc.) indicate whether it is relevant or not to *your* role in a project. If not relevant, go to the next major factor category.

ii) For each relevant major factor category, start by classifying the factors listed as to their degree of importance in impairing productivity (HIGH, MEDIUM, LOW, NONE) by simply entering a check by the factor in the appropriate column. You are encouraged to add items that you feel are important to the list of factors.

iii) Then, for any factors classified as HIGH in importance, rank the most important three by entering numbers in the column labelled "Rank Top 3", using "1" as the most important.

MAJOR FACTOR CATEGORY No. 1 PROJECT CONDITIONS

___ RELEVANT (complete table below) ___ IRRELEVANT (go to next factor category)

FACTOR NUMBER	RANK TOP 3	PROJECT CONDITION FACTORS WHICH MAY IMPAIR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
1.1	____	Remote project location				
1.2	____	Very large-scale project leading to communication and motivation problems				
1.3	____	Project technologically complex				
1.4	____	Project first of a kind				
1.5	____	High seasonal variability in weather				
1.6	____	Difficult working conditions due to climate, topography				
1.7	____	Project has significant environmental impact causing delays				
1.8	____	Project requires high level of quality control & government inspection				
1.9	____	Overtime and over-manning required because of owner requirements				
1.10	____	Congested layout of permanent facilities				
1.11	____	Indecisive owner				
1.12	____	Use of fast-tracking				
1.13	____	Work slowdowns because of financing constraints				
1.14	____	Scheduled project duration and/or seasonal variability requires overtime and/or shift work				
1.15	____	Public versus private sector project sponsorship				
1.16	____	Inadequate working conditions (housing, sanitation, etc.)				
1.17	____	Substantial travel time to and from work place				
1.18	____	Other _____				
1.19	____	Other _____				

MAJOR FACTOR CATEGORY No. 2 MARKET CONDITIONS

___ RELEVANT (complete table below) ___ IRRELEVANT (go to next factor category)

FACTOR NUMBER	RANK TOP 3	MARKET CONDITION FACTORS WHICH MAY IMPAIR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
2.1	____	Overtime required as inducement because of competition from other projects				
2.2	____	Hoarding of labour due to competitive demand from other projects				
2.3	____	High turnover of labour				
2.4	____	Market conditions require use of lenient contract conditions (e.g., cost plus, etc.)				
2.5	____	Material and/or equipment shortages				
2.6	____	Lack of experienced design and/or project management personnel				
2.7	____	Lack of experienced tradesmen				
2.8	____	Other _____				
2.9	____	Other _____				

MAJOR FACTOR CATEGORY No. 3 DESIGN AND PROCUREMENT

___ RELEVANT (complete table below) ___ IRRELEVANT (go to next factor category)

FACTOR NUMBER	RANK TOP 3	DESIGN AND PROCUREMENT FACTORS WHICH MAY IMPAIR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
3.1	___	Poor quality of drawings and specifications				
3.2	___	Over-demanding specifications				
3.3	___	Poor detailing				
3.4	___	Insufficient attention to constructibility of the design				
3.5	___	Use of joint venture for design and project management				
3.6	___	Large number of design changes requiring change orders and/or rework				
3.7	___	Ineffective communication mechanisms for clarifying design details and changes				
3.8	___	Slow and–or indecisive decision making re design details & changes				
3.9	___	Insufficient consideration of construction safety in design detailing				
3.10	___	Inadequate planning and scheduling of design process				
3.11	___	Inadequate planning and scheduling of procurement process				
3.12	___	Insufficient expediting of major equipment and materials purchases				
3.13	___	Inadequate or overzealous inspection during procurement phase				
3.14	___	Insufficient prequalification of contractors, suppliers				
3.15	___	Poor work packaging				
3.16	___	Poor use of contract types/terms				
3.17	___	Other ___				
3.18	___	Other ___				

MAJOR FACTOR CATEGORY No. 4 MANAGEMENT OF CONSTRUCTION PHASE

____ RELEVANT (complete table below) ____ IRRELEVANT (go to next factor category)

FACTOR NUMBER	RANK TOP 3	MANAGEMENT FACTORS WHICH MAY IMPAIR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
4.1	____	Inadequate use of planning and scheduling techniques				
4.2	____	Lack of realism in estimates for planning and scheduling				
4.3	____	Insufficient use of feedback from previous projects				
4.4	____	Inadequate manpower levelling				
4.5	____	Inadequate productivity measurement methods				
4.6	____	Inadequate materials handling procedures				
4.7	____	Insufficient availability of small tools				
4.8	____	Unbalanced crew & equipment spreads				
4.9	____	Insufficient feedback on progress to identify problems requiring corrective action				
4.10	____	Lack of speedy feedback & initiation of corrective action				
4.11	____	Ineffective use of contract types & terms				
4.12	____	Ineffective communications between owners, designers, contractors, suppliers, labour				
4.13	____	Poor coordination between contractors				
4.14	____	Inefficient layout of site operations, facilities				
4.15	____	Insufficient supervisory personnel				
4.16	____	Supervisory personnel (field engineers, superintendents, foremen) lack sufficient management training				
4.17	____	Inadequate or overzealous inspection				
4.18	____	Inadequate or overzealous safety program				
4.19	____	Excessive use of overtime				
4.20	____	Excessive use of shift work				

(continued)

4. Management of Construction Phase (continued)

FACTOR NUMBER	RANK TOP 3	MANAGEMENT FACTORS WHICH MAY IMPAIR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
4.21	____	Inadequate equipment maintenance program				
4.22	____	Insufficient R & D and use of new technologies				
4.23	____	Inadequate drawing control				
4.24	____	Poor work-packaging leading to too many contractors on site				
4.25	____	Inadequate change order processing and control mechanism				
4.26	____	Lack of incentives for high productivity				
4.27	____	Other _____				
4.28	____	Other _____				

MAJOR FACTOR CATEGORY No. 5 LABOUR

____ RELEVANT (complete table below) ____ IRRELEVANT (go to next factor category)

FACTOR NUMBER	RANK TOP 3	FACTORS WHICH MAY IMPAIR LABOUR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
5.1	____	Union rules too restrictive				
5.2	____	Training of tradesmen inadequate				
5.3	____	Lack of experienced tradesmen				
5.4	____	Labour opposed to productivity improvement efforts				
5.5	____	Labour inadequately informed about project goals				
5.6	____	Labour receives inadequate instruction re tasks				
5.7	____	Labour working conditions (housing, sanitation facilities, availability of small tools) inadequate				
5.8	____	Desire for overtime reduces productivity during regular hours				
5.9	____	Safety concerns used as excuse for low productivity				
5.10	____	Absenteeism				
5.11	____	Mobility and turnover				
5.12	____	Contract type				

(continued)

MAJOR FACTOR CATEGORY No. 5 LABOUR (continued)

FACTOR NUMBER	RANK TOP 3	FACTORS WHICH MAY IMPAIR LABOUR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
5.13	____	Jurisdictional disputes				
5.14	____	Use of prefabrication restricted by collective agreement				
5.15	____	Lack of motivation				
5.16	____	Temporary work assignments				
5.17	____	Other _____				
5.18	____	Other _____				

MAJOR FACTOR CATEGORY No. 6 GOVERNMENT POLICY AND REGULATIONS

___ RELEVANT (complete table below) ___ IRRELEVANT (go to next factor category)

FACTOR NUMBER	RANK TOP 3	GOVERNMENT POLICY AND REGULATION FACTORS WHICH MAY IMPAIR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
6.1	____	Environmental regulations				
6.2	____	Mobility restrictions				
6.3	____	Lack of speedy approvals and issuance of permits				
6.4	____	Inappropriate safety regulations				
6.5	____	Restrictive codes and standard				
6.6	____	Lack of appropriately trained government inspectors				
6.7	____	Tax regulations which affect construction equipment replacement				
6.8	____	Poor timing of public sector vs. private sector projects				
6.9	____	Lack of government support for construction R & D				
6.10	____	Lack of effective consultative mechanisms between industry and government				
6.11	____	Other _____				
6.12	____	Other _____				

MAJOR FACTOR CATEGORY No. 7 EDUCATION AND TRAINING

____ RELEVANT (complete table below) ____ IRRELEVANT

FACTOR NUMBER	RANK TOP 3	EDUCATION AND TRAINING FACTORS WHICH MAY IMPAIR PRODUCTIVITY	DEGREE OF IMPORTANCE			
			HIGH	MED.	LOW	NONE
7.1	_____	Lack of appropriate training programs for skilled tradesmen				
7.2	_____	Lack of management training programs for supervisory personnel				
7.3	_____	Lack of appropriate management programs for project management personnel				
7.4	_____	Lack of appropriate training programs for union representatives on projects				
7.5	_____	Insufficient documentation and analysis of experiences from past projects				
7.6	_____	Lack of effective safety training programs				
7.7	_____	Ineffective technology transfer programs and media				
7.8	_____	Other _____				
7.9	_____	Other _____				

D) RANKING OF MAJOR FACTOR CATEGORIES

Please rank the preceding seven major factor categories listed below. A rank of 1 means that the category is the most important in terms of impairing productivity.

_____ Project Conditions
_____ Market Conditions
_____ Design and Procurement
_____ Management of Construction Phase
_____ Labour
_____ Government Policy and Regulations
_____ Education and Training

_____ Date: _____
Signature

Name: _____ Phone: _____

Organization: _____

Address: _____

_____

Please mail your completed questionnaire(s) to:

Construction Industry Development Council
235 Queen Street
7th Floor East (85)
Ottawa, Ontario
K1A 0H5 (Telephone: (613) 995-8107)

Annex B

Organizations Participating in the CIDC Survey on Factors Impairing Construction Productivity

Appreciation is expressed to the following organizations for either distributing copies with a covering letter or providing a mailing list. (In either case, the distribution was on a selected basis designed to achieve good nationwide representation.)

- Association of Consulting Engineers of Canada
- Building Trades Councils (38 across Canada)
- Canada Construction Association and member associations
- Canadian Electrical Contractors Association
- Canadian Institute of Public Real Estate Companies
- Canadian Institute of Steel Construction
- Construction Owners Association of Alberta
- Construction Owners Council of Ontario
- Employers Council of British Columbia
- Housing and Urban Development Association of Canada
- Mechanical Contractors Association of Canada
- Pipe Line Contractors Association of Canada
- Royal Architectural Institute of Canada
- Urban Development Institute of Canada and Alberta Chapter

7 Government Regulations

7.1 Introduction

7.2 General Regulatory Reform

7.3 Government Regulations Related to Construction Projects

- **7.3.1** Environmental Regulations
- **7.3.2** Regulations on Land Development and Planning
- **7.3.3** Construction Material Standards and Building Codes

Annex A: Guidelines on Regulation Procedures

Annex B: Government Regulations

Annex C: Effects of Environmental Regulation

Annex D: Report of Plan Processing for Land Development - Edmonton

7 Government Regulations

7.1 Introduction

The construction industry has a compelling concern about regulations.

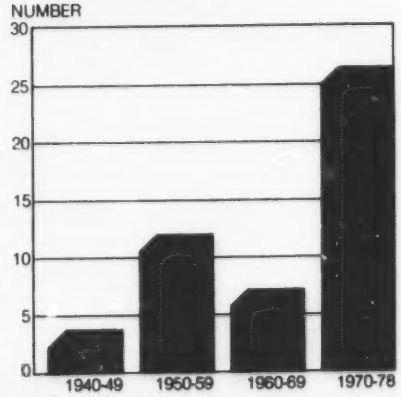
First, its members' operations are subjected to myriad regulations administered by all levels of government — perhaps more than any other industry.

Second, the uncertainties, delays, and costs of unduly onerous regulations place many construction projects in jeopardy. These capital cost factors can and do cause the cancellation of desirable projects or, at the very least, unnecessary additional expenses to the owners and ultimately to the public without commensurate benefits.

Accordingly, members of the construction industry have both a general interest in regulatory reform and a specific interest in the rescinding or revision of unreasonable regulations that adversely affect the initiation of worthwhile capital projects.

In 1978, the Construction Consultative Task Force recommended relief for three specific areas of concern — environmental regulations, requirements for urban land development, and construction codes and standards — on the grounds that the procedures often caused excessive delays and inflated costs and in general failed to achieve a viable benefit/cost ratio.

ENACTMENT OF NEW FEDERAL REGULATORY STATUTES, 1940-1978



Source: Economic Council of Canada
Business Committee on Regulatory Reform.

The terms of reference for the CIDC Study Group on Government Regulations, appointed in 1981, were limited to the above three areas of concern, with special focus on the effect of their regulations on the initiation of new construction projects.

In 1979-1980, the CIDC specifically recommended to the Canadian standards writing organizations and to the National Building Code Committee and provincial building code committees that all proposed revisions be subjected to an economic impact study before being processed.

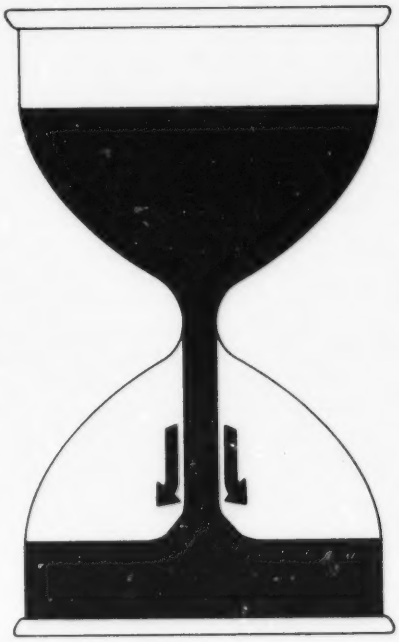
The surge in the 1970s towards the enactment of more and more regulations has been analysed by the Economic Council of Canada. It reported that senior governments in Canada had 1 461 regulatory statutes on their books in 1970. By 1978, the number had grown to 1 948, a 20 per cent increase. The federal government's share was 26 new regulatory statutes, more than the total enacted in the preceding thirty years. The total number of federal regulatory statutes in 1978 was 140 (7 per cent of the total), with 916 appended regulatory instruments, running to 9 475 pages of text.

Statistics do not tell the whole story. There has been a trend towards increasingly stringent requirements. Moreover, a new dimension has been experienced — regulations, issued by different agencies, operating at cross-purposes.

The inescapable reality is that the cost of government regulations must ultimately be paid for by individual Canadians. If the benefits do not exceed the costs, the general public suffers. In this regard, it should be stressed that *total* costs should be considered, not just the government's administrative costs. A U.S. study estimated that the private sector's costs of compliance with U.S. federal regulations were *twenty times higher* than those costs by the government itself.[1] No comparable overall study has been made in Canada, but the cost of compliance study conducted by Woods, Gordon for the ECC Regulation Reference in 1981 illustrated how onerous regulations could be.

Indeed, the excessive burden of regulations is now so well documented and recognized that the CIDC study group quickly concluded that no new studies were necessary. Many detailed and well-financed studies had already been executed, problems identified, recommendations made, and some very commendable initiatives taken to implement remedial action.

"THE SANDS OF TIME" COST MONEY AND PROJECTS



In short, the main need was seen to be for governments at all levels to accord regulatory reform a higher priority so that the problem would be dealt with more rapidly and extensively.

However, in preparing this report, the study group examined a considerable number of studies dealing with the problem of excessive, non-cost-effective regulations (see the Bibliography). The study group also obtained extensive documentation from the Treasury Board of Canada about the federal government's regulatory reform program. Moreover, individual members of the study group prepared papers on each of the three areas of concern previously dealt with by the Construction Consultative Committee in 1978.

[1] Murray L. Weidenbaum, *The Cost of Federal Regulation of Economic Activity* (American Enterprise Institute, 1978).

7.2 General Regulatory Reform

Regulatory reform poses a formidable challenge. To make real progress, it is necessary to attack the problem at its roots by concentrating on the processes that generate regulations.

Regulatory reform is not simply a question of reducing the number and complexity of government forms, deregulating certain sectors of the economy, or reducing bureaucratic red tape. Although all these factors are involved, more basic issues must be faced.

First, regulatory reform involves a reassessment of the role of government in society. Firm political decisions must be made when faced with a social or economic problem to determine whether government should intervene at all and what type of approach is called for.

Second, regulatory reform is a question of effective government management. There is a need to consult with affected parties to evaluate the total costs of compliance, to compare alternatives, and to develop cost-efficient procedures. Furthermore, existing programs must be reevaluated to ensure that they still effectively reflect changing public policy.

The Business Committee on Regulatory Reform prepared some guidelines that outline the basic criteria that should be applied to proposed or existing regulations (see Annex A). These guidelines are strongly supported by the study group.

The Economic Council of Canada's Reference on Regulations was conducted in response to a request agreed to at the Federal-Provincial Conference of First Ministers held in February 1978 that "the whole matter of economic regulation at all levels of government should be referred to the Economic Council for recommendations for action in consultation with the provinces and the private sector . . ."

The subsequent ECC report and many other studies have demonstrated clearly the pressing need for regulatory reform. The prime minister of Canada gave the Treasury Board a special assignment to coordinate the federal government's activities in this field. Its objectives are specifically to improve public administration reforms to the regulatory process and to reduce the regulatory burden on the Canadian economy.

Among the comprehensive list of Treasury Board projects are the requirement of "regulatory impact assessments prior to decisions on new regulations" and the "inclusion of regulatory programs in Departmental program evaluation plans". At the end of May 1983, the president of the Treasury Board released the first issue of semiannual regulatory agendas, which gave — in some 550 pages — advance notice to interested parties of the plans of ten departments and four regulatory agencies.

A number of the provincial governments have also appointed regulatory reform coordinators, task forces, etc., to provide a focus for their activities in this area. The programs for regulatory reform of the provincial governments are additionally important because of their influence on municipal governments.

Although these initiatives are gratifying and some worthwhile progress is being made, the situation among governments and their respective departments and agencies is quite mixed. Also, the programs for regulatory reform are in general behind schedule. The subject obviously needs to be given a higher priority, enjoy the (continued) support of the prime minister or premier, and be made the responsibility of a senior minister. Regulatory reform is an essential element of good government and should be lodged with the minister or municipal councillor who has the government management portfolio or is at least close to the first minister's or the mayor's office.

Recommendation 7.1 That regulatory reform be accorded high priority by the leaders of all governments in Canada; that responsibility for the execution of programs in this area be assigned to a senior cabinet or council member; and that periodic progress reports be required.

Recommendation 7.2 That members of the private sector assist in the advocacy and implementation of regulatory reform and identify regulations that cause unnecessary delays and outlays.

Recommendation 7.3 That economic recovery be stimulated by the speedy revision of unduly onerous regulations that impede the start of desirable projects; and that, as a general procedure, each regulation should automatically expire after a specified period of from two to five years, unless its continuance is justified by an independent body's regular evaluation.

7.3 Government Regulations Related to Construction Projects

A section of the 1978 report of the Construction Consultative Task Force dealt with regulations governing urban land development, construction codes and standards, and environmental regulations (see Annex B). Members of the study group contributed papers on current conditions in these three areas.

The papers form the basis for the following summaries. Inasmuch as the study group members were mainly from Alberta, many of their references were to regulations encountered in that province. However, this material illustrates conditions experienced throughout Canada.

7.3.1 Environmental Regulations

The protection and preservation of the environment are objectives that are strongly supported by the construction industry. It is the application of environmental regulations that causes widespread concern.

The increasingly stringent environmental requirements have in all too many cases resulted in inordinate and unjustified expenditures without any clear evidence that worthwhile improvements in environmental quality have resulted. Moreover, this procedure can be so lengthy and complex that they also can affect the economic viability of a project.

Among the main specific areas of complaint are the following.

1. *The zero-risk philosophy*. There is no such thing as zero risk in society. If this criterion is applied to environmental regulations, costs are increased to the point that development cannot proceed.
2. *The double-standard syndrome*. A project in an isolated region may be required to be squeaky clean, whereas raw sewage may well occur in certain metropolitan cities.
3. *Uncertainty over environmental standards*. All too often it is necessary to prepare a number of project proposals until one is accepted.

4. *Overlapping jurisdictions.* Not only different regulatory requirements but also different schedules have to be met; the whole process consequently becomes additionally prolonged and costly.

These and other factors are illustrated in Annex C.

Recommendation 7.4 That benefit/cost analysis be an integral part of the development of blanket regulations on environmental control.

Recommendation 7.5 That regulatory authorities establish, in consultation with interested parties, environmental objectives appropriate for specific regions and conditions, guidelines, and procedures, with the object of reducing the time and expense now incurred by project sponsors and their agents.

Recommendation 7.6 That a review be made by the various levels of government of their environmental regulations to determine conflicts, overlaps, and obsolescence and to explore the scope for combined jurisdictional hearings.

7.3.2 Regulations on Land Development and Planning

Urban land development is another area of regulation that has been the subject of a great deal of complaint and detailed studies.

Again, the principal causes of concern are the time and costs involved in the escalating requirements related to applications to develop land — costs that are ultimately borne by the user.

The issues are similarly well documented, and there was no need for the study group to carry out yet another study. However, a brief description of the processes involved in the development of a subdivision in Edmonton is appended as a typical example of the lengthy procedures that are called for. The account also reflects the frustrations of those attempting to provide a high-quality urban environment at a cost that Canadians can afford (see Annex D).

Another example that illustrates the increasing complexity and cost of the development process is a comparison of the procedures followed in Alberta in 1955 and in 1975.

In 1955, an application for approval of a satellite town on the southeast edge of Edmonton was made to the Alberta government. An outline plan for 2 000 acres with a neighbourhood plan for a first-stage development was prepared and submitted to the provincial planner.

In one meeting, the provincial planner pointed out three or four deficiencies that were contrary to the planning regulations. The plan was redrawn in two days and received the approval of the provincial planner the next day and then of the minister of municipal affairs. Within two months, five display houses were under construction; within nine months, most of the first 100 houses in the subdivision were occupied.

About twenty years later, in Calgary, an application was made for annexation of about 5 000 acres of land. All the necessary economic analyses for development were presented to the city. Many of the city staff were satisfied with this information, but once the process started, it had to run its inexorable course. Many more studies were carried out, hearings were held, and after five years and about $500 000 had been expended by the developer, approval was given. In the first case, the elapsed time between making the application and the first families moving into the homes was about nine months. In the second case, the elapsed time was about seven years.

The final results of both procedures in terms of quality and benefits were quite comparable — no significant advantages seemed to be gained from the longer process. However, a significant extra cost was borne by each home buyer.

In some instances, the pressures by developers for speedier processing have led the municipal planning department to request additional personnel. But there appears to be a point of diminishing returns: the more people there are, the more hands there are for papers to pass through, the more officials there are who may feel compelled to justify their existence, and the overall process may well be lengthened instead of expedited. A more positive approach would be to review existing and proposed regulations to ensure that they are cost effective and otherwise worthwhile.

Recommendation 7.7 That a realistic assessment be made of each existing and proposed regulation on land development and planning to ensure that its overall benefits justify the costs; and that there be periodic reevaluations.

7.3.3 Construction Material Standards and Building Codes

The construction industry has long advocated the development and specified use of material standards and the adoption of the National Building Code of Canada. Such use not only protects the public interest but also greatly helps facilitate many aspects of the construction process.

The number of standards related to construction materials, components, and prefabricated building structures is large: for example, over 800 standards were identified as requiring conversion to metric (SI) as part of the Canadian construction industry's metrification program.

In recent years, the effect of inflationary pressures on energy and construction costs and problems related to the built environment have combined to generate a new awareness of economic and social implications of standards established in the construction sector. Any revised or new provision of a standard or building code should be subjected to careful benefit/cost analysis, just like any other regulation.

The increased programs of the Canadian standards writing organizations and the Standards Council of Canada have been significantly augmented in recent years by

1. the development of the Government Master Construction Specification and its extension to the Canadian National Master Construction Specification (NMS) for use in private projects
2. the trend whereby the provincial and territorial governments have adopted uniform building regulations (codes) for their respective areas, based very largely on the National Building Code of Canada; or require municipalities with building regulations to use the national code; or are encouraging municipalities to do so.

These documents make very extensive use of standards. In general, the technical committees of the standards writing organizations and the National Building Code do consider the cost implications of proposed provisions. However, it has been reported that the pressure of work and other constraints sometimes make the application of this policy less than perfect. Cost implica-

tions may well become all the more important in the decades ahead.

Care should also be taken to ensure that the use of innovative materials, applications, or techniques is not thwarted by the absence of provisions in standards and codes to accommodate them. Procedures should exist whereby special consideration can be given to such new technology. Similarly, it is most important that the various jurisdictions adopt the latest edition of the National Building Code or otherwise ensure that their own building regulations are up to date. For example, some major provinces are still using a building code based on the 1975 edition of the National Building Code.

Recommendation 7.8 That all committees that develop or revise mandatory standards and codes in the construction sector include in their deliberations economic and social criteria along with those of a technical, safety, and legal nature; and that consideration be given as a standard procedure to the effect of proposed requirements on the costs of design, approval procedures, materials, construction, supervision, and operation.

Recommendation 7.9 That the provincial and territorial governments adopt uniform building standards (codes), based on the latest edition of the National Building Code of Canada, for their respective jurisdictions.

Annex A*

Guidelines on Regulation Procedures

1. It should be demonstrated that the regulation is needed, is compatible with other government policies, and does not overlap or duplicate other regulations.
   No regulation should be undertaken without a strict specification of need. It should be clearly demonstrated that the regulation in fact responds to this need.
2. It should be shown that the least burdensome of alternative approaches has been chosen.
   Alternative types of regulation and alternatives other than regulation (along with the alternative of no government action) need to be assessed.
3. It should be shown that the social and economic benefits of the proposal outweigh its costs.
   This is the litmus test of sensible government. Assessing costs against benefits is crucial in determining whether the proposed measure is effective in accomplishing its purpose and makes efficient use of economic resources.
4. Interested parties should have adequate opportunity to participate in this process, starting with the development of policy and the demonstration of need.
   Consultation is essential to ensure that costs are accurately estimated, alternatives considered, and enforcement procedures efficient and businesslike.
5. Regulations and their governing statutes should be written simply and clearly. Policy directives should be fully spelled out and the mandate given to any regulatory bodies strictly defined.
   We are concerned about the increasing reliance on vaguely worded "enabling legislation" for regulatory programs. We believe that as a matter of principle, regulations under any bill should be drafted and submitted to the legislature and its committees at the same time as the governing legislation.
6. Each regulation should automatically expire after a specified period (2 to 5 years) unless its continuance is justified by an independent body's regular evaluation.
   The regular evaluation of existing progress is a principle of sound management.

* Prepared by the Business Committee on Regulatory Reform, 1980.

Annex B*

Government Regulations

Most government regulations have been developed for the specific purpose of increasing public safety or for protection of the public interest. At the time of issue each regulation was assumed to carry a net benefit for the groups directly involved. But there has been too little concern for the indirect and secondary effects as well as the cost of the regulatory process itself. Moreover, with the passage of time, changes in costs and benefits have not been assessed, nor has the cumulative effect of overlapping regulations within and among the several levels of government.

But recently the federal government has announced that all new federal regulations in health, safety and fairness (HSF) areas must be subjected to a benefit-cost assessment which will be made publicly available in sufficient time prior to promulgation of the regulations to allow for private sector representation to sponsoring departments. Ontario and other provinces have made similar moves.

Of even wider significance was the agreement by the first ministers in February 1978 that "the whole matter of economic regulation at all levels of government should be referred to the Economic Council for recommendations for action in consultation with the provinces and the private sector".[1]

The construction industry welcomes this initiative and would direct attention to the benefits to be gained from greater

* Extract from *A Report by the Sector Task Force on the Canadian Construction Industry*, 1978.

[1] Federal-Provincial Conference of First Ministers, Conclusion of the Conference.

harmonization among and within provinces with regard to construction-related codes, standards, regulations and labour qualifications; from rationalization of the requirements to protect and improve the natural and social environment; and from reductions in the paper burden.

The federal and some provincial governments have moved to reduce the burden of paperwork particularly as it affects small businesses. The construction industry, with its high proportion of small units, is concerned not only that the flow of paper be restrained but also that it be made more effective in disseminating useful technical and market information.

Urban Land Development

In the residential sector deep concern has been expressed over the impact on costs of the large number and successive layers of approval required in the development of land. In some provincial jurisdictions up to 90 steps in the approval are required in the development of land. In some only is there a large direct cost for administration incurred both by government and the land developers, but substantial carrying charges are accumulated on land held for five years or more before all clearances are received. These costs effectively screen out most small developers, who do not have the working capital to wait out the process.

Even more significant in raising the price of residential and industrial land much higher than in most American locations is the effect of restricting the supply of developable land in Canada. With a better supply of land available for development, and final approval systems as short as three months, the real land costs to builders and clients in most United States jurisdictions are a fraction of the Canadian (a typical housing lot in the U.S. at $8-10 000 would compare with a lot in Canada at $20-25 000). Canadian developer-builders are showing both their competitive capabilities and their reaction to the Canadian market situation by rapidly increasing their activity in the United States.

In part the Canadian situation reflects the attitudes of small but highly vocal groups which advocate "no growth" or "slow growth" and attempt to achieve their aims by restricting land development. The effect of limited supply is high prices for existing as well as newly developed property.

Whatever the objectives of the approval systems, it would appear that governments, especially the provinces, would have much to gain by reducing the excessive requirements of local authorities, by setting time limits on approval processes and perhaps by having a number of requirements approved on a concurrent and mutually acceptable basis.

Construction Codes and Standards

The provincial governments are to be commended for their general adoption of the basic National Building Code. However, the code is continually being updated to reflect changes in technology, as well as economic and social factors. Only a few provinces have arranged for any degree of continuity in adoption of amendments, while others for various reasons have not approved recent changes. There are, therefore, considerable differences in the precise application of the National Building Code among the provinces, and sometimes within the provinces, which add to planning and performance costs of contractors and others attempting to operate across provincial boundaries.

The variations in application of the fire, safety and other codes and regulations across the country increase the barriers and multiply the costs faced by the industry. Provincial governments, in recognition of the benefits of lower costs resulting from greater harmonization, are urged to expedite their adoption of construction-related codes and standards developed by nationally representative bodies.

It is further recommended that the criteria for the development of codes and standards be broadened to include economic and social factors. Traditionally in the construction industry, conditions of safety, technical or structural integrity or legal consistency have been the principal criteria used. With the recent pressures of inflation, rising energy and construction costs and social problems associated with the built environment, a new awareness for the social and economic implication of building regulations has emerged. This does not mean that these new factors would outweigh the others, but rather that they would form an integral part of the basic assessment.

Environmental Regulation

The renewed concern for the natural and social environment is shared by the construction industry. However, governments must appreciate the substantial costs involved in change and delay. Even where no substantive change is required, the delays in the process of study and approval increase the costs of working capital especially when, in our climate, a construction season is lost.

The incidence of regulations for protection of the natural environment can be particularly onerous on the resource extraction and processing industries, which, as the keystones of the Canadian economy, are among the principal clients of the construction industry. Major cost increases and other problems may arise from conflicting or overlapping regulations, or requirements which pay insufficient heed to competitive conditions, or to the specifics of the regional or corporate situation. Continued investment in the resource sector is a necessity for the economic health of most regions, as well as the country as a whole. If, because of unrealistic requirements, this new investment is not placed in Canada, major elements of the construction industry would be among the first to suffer.

Recommendation: That the impact of government regulation on the performance and costs of construction and other industrial activity be assessed, with the purpose of recommending improvements. The construction industry

a) welcomes the study by the Economic Council of Canada of "economic regulation at all levels of government" commissioned by first ministers, and directs the Council's attention particularly to the benefits to be gained from greater harmonization among and within provinces with regard to construction-related codes, standards, regulations and labour qualifications; from rationalization of the requirements to protect the natural and social environment; and from reduction in the paper burden;

b) recommends the inclusion of economic and social criteria in the assessment of codes and standards related to the construction industry at all levels of government, and the publishing of economic impact statements, detailing in a quantitative manner the costs (on the industry and its clients) and the anticipated benefits of each code or standard;

c) commends provincial governments for adopting the National Building Code or uniform building standards based on it, and urges them to expedite the implementation of the latest amendments to that code and adoption of other construction-related codes and standards, in order to improve the mobility of the construction industry;

d) urges upon the provincial governments the need for rationalization and streamlining of the large number of approvals in the land development process, which lead to long delays, restricted supply and high prices, in order to reduce significantly the costs which are now borne by residential, industrial and commercial clients;

e) supports the resource-processing and similar industries in their concern that in applying environmental regulations full consideration be given to the cumulative effect of legislative requirements in all jurisdictions and by all agencies, and to the specific regional and corporate situation.

Annex C*

Effects of Environmental Regulation

1 Introduction

It is very apparent that the degree of environmental regulation and associated costs are increasing with time, although in many cases it is difficult to assign a specific number to these increasing costs. The increasingly stringent environmental requirements are resulting in very significant resources of the country being allocated to meet these requirements without any clear evidence that worthwhile improvements in environmental quality result.

The purpose of this study is to examine some of the areas where environmental control and environmental regulation have resulted in inordinate and unjustified expenditures. The purpose is also to examine approval procedures that are so lengthy and complex that the procedures themselves affect the economics of the project.

2 Impact of Environmental Regulation on Development

In regard to a major resource development project such as an oil sands plant, a petrochemical plant or a thermal power plant, environmental regulation can have significant impact on predevelopment activities, that is, prior to final government approval for the development. The vagueness of the requirements could result in unacceptable time delays.

2.1 Approval in Principle

It is difficult for industry to determine how much information the government requires before industry can make a decision whether or not to proceed with a given project.

A site selection study might be required for a "greenfield" site, that is, a potential site not close to other major industrial development and not on industrial zoned lands. Tentative approval might be required for a greenfield site before land optioning can take place and this requirement may impose some difficulty on industry in preserving confidentiality.

Government policy on industrial decentralization may be at odds with industry requirements and with government policy at the local level. The selection of a greenfield site might require both political and technical considerations; for example, there might be political pressures at the local level on industry to locate in specific parts of the province, because of the accrual of industrial tax to the specific county or municipal district in which a major plant might be located.

Approval in principle may take six months or longer. It is not possible to determine how long this initial approval process will take at the commencement of the site selection investigations. In addition, associated costs to industry for obtaining approval for a given location cannot be predetermined accurately.

2.2 Environmental Impact Assessment Requirements

Procedures for Environmental Impact Assessment (EIA) pose major problems for industry, government and the public. One possibility is that the Environmental Impact Assessment process might be required in more than one jurisdiction with overlapping requirements. This is shown in the following example for environmental requirements for a West Coast petrochemical tank farm that might be under three jurisdictions:

1. B.C. provincial agencies
2. federal Environment Assessment Review Office
3. TERMPOL (Canadian Coastguard).

This triple process could take up to five years to obtain all the necessary approvals, although acceleration of this process is feasible if the three jurisdictions can mutually agree.

Considerable industry/government dialogue is required during the preparation of an EIA in order to satisfy government requirements. The requirement for technical information in the EIA is increasing with time and this may be difficult to provide the government agency. The assessment of gaseous emissions and liquid discharges prior to the design of a major plant complex is sometimes not feasible.

2.3 Government Approval Process

A major project cannot commence in Alberta until an Order in Council is received, that is, cabinet approval; however, approval at the local government level is also required before construction can proceed. It is feasible that a proposed industrial development could obtain cabinet approval but not local government approval.

The approvals required by multiple government jurisdictions can be time delaying on the project; for example, the minimum period for a major development on a greenfield site is eighteen months from preliminary discussions with government officials to receiving

* Prepared for the CIDC by Dr. A. Lamb, 1982.

cabinet approval. This period of time could be easily doubled in the event of any holdups in the approvals process that comprises a number of sequential steps.

2.4 Applications Process

Once a specific plant is approved, there are many applications that are required under various government acts and regulations in various provincial government departments. There is no single agency that acts as a "window" for these applications.

Permits and licences are required to carry out the various site-related activities and construction activities that ultimately result in completion of construction and plant start-up. The detail of the information required by the government agency for an application for a given permit or given licence is very dependent on the specific government department.

Information requirements for government departments may be very specific or may be vague; however it is very necessary to communicate closely with a specific individual within the government department, early in the development and throughout the processing of the applications.

The processing of applications is both time consuming and costly; the individual responsible requires the appropriate technical expertise and the ability to communicate with government officials. Costs could be in the range of $200 000 to $400 000 for a major power plant and mine; this cost includes the preparation of the applications for permits and licences, the collection of the necessary and detailed information that is submitted with the application and the execution of any appropriate studies.

Federal jurisdiction may apply in some cases; in the case of a plant utilizing water from the North Saskatchewan River, this is considered a navigable water and the Federal Navigable Waters Act applies. The Federal Environmental Protection Service is an additional government agency whose requirements must be satisfied.

In Alberta, prior to the development of a greenfield site, an Historical Resources Impact Assessment will be required under the Historical Resources Act. The requirements for this assessment are not clearly defined but detailed archaeological investigations are required before the construction phase of a project in which the land surface is disturbed can commence.

This process can be very time consuming both in terms of manpower and elapsed time and the costs cannot be predicted with any degree of certainty. One greenfield plantsite required an initial archaeological investigation costing approximately $5 000 with no additional work. A second greenfield site required initial archaeological investigations of the same order of magnitude and further detailed investigations and mitigation in the order of $100 000–$200 000.

2.5 Public Involvement

The requirements for public input and output on a major resource development are changing with time as the government representatives become more knowledgeable in dealing with the public and in developing "public participation programs".

There has been a definite trend in Alberta away from the public meeting scenario to an Open House; this latter approach enables public issues to be defused by the "one on one" basis of an Open House. Local government pressure might encourage industry to locate in a specific county; this local encouragement may not be related to employment but to the industrial tax that accrues to the county.

It appears that the specific role of the public in major developments is vague and undetermined; in addition, the requirement of industry to involve the public in the decision-making process is also vague and undetermined. In spite of the apparent emphasis by government on public input, this input is often neglected in the final analysis and government decision regarding the development of a major resource project.

3 Costs of Meeting Environmental Regulations

Costs of meeting environmental regulations are difficult to calculate; both industry and government have not specifically separated these costs in the past and reliable data are generally not available.

The concept that the "polluter pays" does not receive particularly favourable attention; this may arise because of the viewpoint in the public mind that industry is paying to pollute the environment.

Benefit/cost analysis of environmental control is difficult since the environmental benefits accruing from environmental control are difficult to quantify; in addition, it is sometimes difficult to determine if significant benefits accrue from increased environmental control requirements. It is evident that both industry and government should determine costs of meeting environmental regulations more accurately.

3.1 Sulphur Dioxide

Regulation limits vary across the country; an example is the one-hour standard for sulphur dioxide:

— Alberta - 0.17 ppm
— Manitoba - 0.34 ppm
— Ontario - 0.25 ppm.

The federal government has recently issued guidelines for emissions from power plants. It is understood that there are ongoing discussions between power plant operators and Alberta Environment; nevertheless, this agency has adopted some of the federal guidelines as regulations for new power plants.

The federal emission guideline specifies the quantity of sulphur dioxide that can be emitted per unit quantity of heat generated. In contrast, the present Alberta Environment standard for sulphur dioxide is based on a maximum ground-level concentration of this contaminant. It is noted that the ground-level concentration of sulphur dioxide will depend on the emission rate from the power plant but also will depend on meteorological conditions and topography in addition to background levels of sulphur dioxide.

The federal guideline for sulphur dioxide emissions would result in much lower ground-level concentrations of sulphur dioxide than the present Alberta Environment regulation. There has been no technical justification given for making this standard more stringent for power plants utilizing very low sulphur coal (0.2%).

The cost penalty of installation of flue gas desulphurization to meet the new federal guideline could be in the order of $140 000 000, or approximately 14% of the cost of the plant for an 800 megawatt power plant.

Under the current Alberta Environment standard for ground-level concentrations of sulphur dioxide (0.17 ppm), calculations show that this standard for emissions would be reached at an approximate frequency of 1 in 300 000, equivalent to one hour over the 30-year life of a power plant. It is noted that Alberta does not have an acid rain problem. The lakes are buffered and the soil is sulphur deficient.

It is apparent that the regulatory authority has not considered the benefits (if any) that might accrue from the imposition of this tighter sulphur dioxide emission control limit.

4 Recommendations

A number of specific recommendations follow from this brief discussion on environmental regulation.

1. Both government and industry should obtain more accurate costs of environmental control including administrative costs to government and capital and operational costs to industry.
2. The costs associated with preparing applications for permits and licences are significant; the costs to industry should be determined and manpower requirements of government should also be assessed.
3. The environmental benefit of the imposition of blanket regulations such as the federal guideline for sulphur dioxide should be determined before it is implemented; that is, benefit/cost analysis of environmental control is necessary.
4. A review of regulations at the three various levels of government should be made to determine conflicts and overlaps and to determine the extent of obsolescence in present regulations.

Conclusions

1. The approvals process is very long and costly, taking ten years or more from project initiation to facility start-up, and can affect planning and construction schedules.

   It is difficult for industry to determine how much information the government agencies need before industry can make a decision whether or not to proceed with a given project. This is particularly difficult in the case of an industry locating a major project on a "greenfield" site.

   Approval in principle can take considerable effort on the part of industry and may take significant time (six months or greater). It is not possible to determine how long this initial approval process will take. In addition, costs to industry to obtain approval for a given site location cannot be predetermined.

   Although Alberta Environment and the Alberta Energy Resources Conservation Board have guidelines in regard to the preparation of an Environmental Impact Assessment (EIA), considerable industry/government dialogue is required during the preparation of an EIA in order to satisfy requirements. The idealistic approach of some government representatives makes this step in the process somewhat difficult.

   There are large numbers of different permits and licences required under the various acts for construction of a major facility and operation of that facility. Specific detailed studies may be required in addition to detailed design information submitted as part of an application under one of the acts.

   Semi-continuous dialogue with the various government agencies is required to ensure timely approval of the permits and licences to maintain the project development on schedule. This is a costly, time-consuming and frustrating endeavour and requires specific technical expertise to ensure that each government agency is satisfied.

2. Overlapping jurisdictions of federal, provincial and municipal regulatory authorities is a major area of concern.

   Although there has been some attempt to clarify the roles of the various agencies there remains confusion on overlapping and differing provincial and federal regulations.

   There may be separate hearings under the different regulatory authorities for the same project resulting in significant costs and significant time delays.

   There is also significant duplication of information required by the different regulatory authorities requiring considerable expenditure of time and money by industry to satisfy the requirements.

   There may be some confusion in that regulations under the different jurisdictions may be similar but have differing sets of requirements.

3. If the regulations are too stringent and they cannot be met or can only be met at considerable expense, the specific project may not proceed.

Recommendations

1. The time for the approvals process must be reduced.

   Regulatory requirements for the project should be known at the onset of the project both in terms of location of the facility and in terms of requirements for effluents and emissions control.

   After project approval, the requirements for permits and licences should be detailed on a project-specific basis by the regulatory authority and the approvals process speeded up.

   Industry/government dialogue should commence in the early planning phases of a project, in the approvals and hearing processes, and in the development and acquisition of approvals to construct and approvals to operate under the various provincial acts. This approach is necessary to minimize costs and duration of this multi-faceted task.

2. The requirement to meet regulations under overlapping jurisdictions (federal, provincial, and municipal) should be replaced by a single jurisdiction (possibly provincial).

   A combined jurisdiction hearing and submission of documentation would avoid time delays and reduce costs.

   A single authority (possibly provincial) could ensure that all necessary

requirements are met during project development through to construction and operation of the facility.

The use of uniform regulations across the country with local exceptions would avoid some duplication.

A review of environmental regulations at various levels of government is required to determine conflicts and overlaps and to determine the extent of obsolescence in present regulations.

3. Benefit/cost analysis should be part of the development of regulations.

Although this is difficult, it would avoid the blanket imposition of federal guidelines or regulations or the imposition of other provincial regulations without taking account of local conditions.

Annex D*

Report on Plan Processing for Land Development — Edmonton

Of late, there has been a noticeable change in the review by municipal engineers of subdivision standards. The change is represented by an increasing willingness to consider new systems and materials, as well as new standards, for the hardware necessary to develop land.

It is unfortunate that the same level of response has not been generally experienced within the town planning profession as practised within the municipalities.

To illustrate the kind of problem, and therefore the kind of unnecesary costs which are incurred, the following is an outline of the procedure which must be followed in order to subdivide and develop land with houses.

If the land is not annexed to the host municipality — in this case Edmonton — then an annexation application must be made by the city on your behalf to the Local Authorities Board. Hearings are held and a decision made. (It is interesting to note that the most recent annexation procedure which comprised a massive application by the City of Edmonton for the annexation of lands in all directions took approximately two and a half years from the initiation of the studies to support the application until the provincial cabinet finally considered the recommendation of the Local Authorities Board and rendered a decision.)

For the purpose of the example, it will be assumed that the land is readily serviceable and does not have that damning label of being "premature". The city council must be persuaded first of all to apply for an amendment to the Preliminary Regional Plan in order to have the area designated as urban land from an agricultural designation. That is a minimum two-month procedure once the Regional Planning Commission has received the application, which has to be supported by the appropriate material to indicate that the land may be served with sewer, water, transportation facilities, schools and parks and the other urban infrastructure.

Once the amendment to the Regional Plan is completed, an amendment to the General Municipal Plan may be made. This is achieved by bylaw and receives three readings. A public hearing is held before the city council in order to determine the appropriateness of the amendment to the General Municipal Plan Bylaw and the supporting material must contain information with regard to the provision of sewer and water facilities, transportation, schools and park facilities as well as the balance of the necessary urban infrastructure.

Once the amendment to the General Municipal Plan is complete, the city will consider the passage of a further bylaw which designates the Area Structure Plan for the particular land area in question. The Area Structure Plan must contain further and more detailed information but must also be fundamentally based upon the availability of sewer and water facilities, transportation, school and park facilities, and the balance of the necessary urban infrastructure. A public hearing is held in order to determine the appropriateness of the passage of that bylaw.

Following the passage of the Area Structure Plan Bylaw a further planning document has to be prepared which is the Neighbourhood Structure Plan. This goes into further detail and a bylaw is presented to city council for three readings including the necessary public hearing and must be based upon the availability of sewer, water facilities, transportation and school and park facilities as well as the balance of the necessary urban infrastructure.

Once the Neighbourhood Structure Plan has been approved by bylaw, an application for subdivision may be made to the Municipal Planning Commission (which also has previously considered all the other elements referred to above) and along with the subdivision application goes the amendment to the Land Use Bylaw to specify the appropriate land use designations.

This bylaw is subject to three readings as well as the mandatory public hearing in order to determine the appropriateness of the detailed plan and the designated land uses. The passage of this bylaw will facilitate the execution of the development agreement.

Some of the above steps may be taken concurrently but can be handled entirely separately in the manner outlined.

Incidentally, it is worth noting that the fees paid for the approval process at the various stages exceed the cost of the consultants who prepare the various plans for submission. It is no wonder that the municipal fees are so high with the levels of planning which it seems must be reviewed.

There is no easy solution to a breakthrough in the stranglehold which exists with regard to urban development. However, the complexity of the planning process is now such that it can fairly be said that the role of "facilitator" has become completely subservient to the role of the "controller". What must now be required examination within the municipality is "what is the purpose of the control?". The only way that such controls can be successfully challenged is to challenge them at the political level with a dollar value or perhaps better stated a dollar cost, so that the community can determine the level of expenditure it is prepared to support for the level of real service it receives. It may be useful to close with what has been described as "Boyle's Observation", which reads:

> Municipal government is one that assumes responsibility for the health, happiness and general well-being of all its citizens — except the taxpayers.

* Prepared for the CIDC by P. Ellwood, 1982.

8 Construction Technology

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8 Construction Technology

8.1 Introduction

Construction is technology intensive and has become more and more a high-tech industry. Whereas many construction skills have a tradition stretching back thousands of years, many others are of recent origin. New materials, components, and equipment abound. The scale and complexity of many projects have increased enormously. This trend promises to become even more evident in the future.

Construction activities are technically based. New developments typically pose new challenges that require technical solutions. The increased size and diversity of our construction programs have greatly increased the industry's overall knowledge base and the general level of technical knowledge required of the industry's personnel.

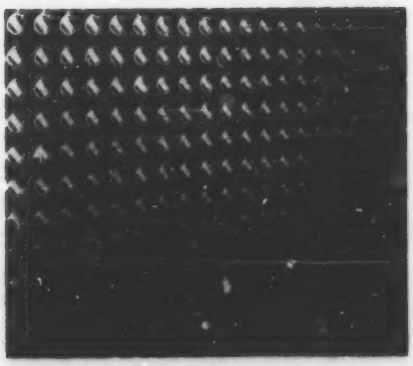
The Canadian construction industry ranks high in performance compared to that of other nations. It is a leader in some fields and has a commendable number of technological developments to its credit. An industry's technology is obtained through its educational and training programs; its information systems; its opportunities to gain practical experience and to introduce innovations; and research and development activities.

In order that the Canadian construction industry maintain its competitive edge in an increasingly competitive world, it will be necessary to devote increased attention to each of these factors.

All Canadians have a vital stake in the attainment of this objective because the efficiency and technological capability of the construction industry have a direct bearing on the costs of production, the costs of transportation, the costs of shelter — indeed on the overall cost of living and ability of the Canadian economy to compete.

8.2 What Are the Challenges and Opportunities?

The Construction Industry Development Council has assessed the changes that are occurring in the construction industry and concluded that the following factors will require technical improvements in the decade ahead. The need for most of these requirements arises from inadequate knowledge of techniques, whose improvement will depend on research, education, and entrepreneurship.



8.2.1 Technology-based Improvement in Productivity

The use of climbing cranes is an example of successful Canadian exploitation of an imported technique to improve productivity. The evolution of large-sized concrete forming systems flown from one floor to another using climbing cranes is a further development that has given Canadian building contractors a decided advantage in construction costs. New, sophisticated Canadian forming systems using aluminum in special extruded beams and scaffold frames (for example, the "Aluma" system) are finding world markets. Further advances could be made in productivity and quality control by increasing off-site prefabrication and minimizing on-site erection time, for example, by using more extensive prefabricated processing units and curtain walls.

Recommendation 8.1 That the construction industry, including its suppliers of materials, plant, and equipment, encourage new techniques of off-site fabrication of structures, plant, and equipment and their components to improve productivity, with particular emphasis on remote sites and large industrial projects.

8.2.2 The Cost Impact of Regulations

Regulations are required to protect workers and the public. The most conservative (and costly) regulations result from inadequate technological knowledge and understanding. Improvements and economies in regulations are achieved by research involving experimentation and observations of performance. As knowledge and experience are developed, codes and regulations become more clear and precise. Their content and interpretation can be more flexible in providing greater scope to economical innovations, as is found in performance codes, for example. Improved technology also results in the development and application of improved safety equipment and procedures with obvious social and economic benefits.

8.2.3 Energy

The cost of energy used in constructing and operating buildings, industrial facilities, and other built works has increased much more rapidly than most other costs. Its cost should be a priority factor in life-cycle costing. There are no cheap sources of energy on the horizon that can be expected to alter this trend appreciably. Energy conservation is therefore of great interest to the construction industry. Market forces will take care of the waste of energy in on-site construction, but more design and construction expertise and ingenuity and their interface will be required to build and operate buildings adapted to the energy future. Building controls, for example, are becoming so complex that more sophisticated practitioners will be required for the design, installation, and operation of mechanical/electrical systems. There is also a great need for better control of air leakage from buildings, both to save energy and to reduce degradation of the building fabric.

Recommendation 8.2 That the construction industry and governments continue to support and encourage research leading to the reduction of the cost impact of regulations, the optimal conservation of energy in buildings, and improved safety conditions.

8.2.4 Education and Training for the Construction Industry

As construction becomes more complex, it becomes necessary to provide better education and training to those executing it at all levels. Significant initiatives have already been taken by some universities in providing degree courses for undergraduate or post-graduate students in building engineering, construction engineering, or construction management. Other universities have concentrations of related courses within their civil engineering curriculum. However, industry must show greater interest and involvement in these initiatives to ensure their continuation and relevance to industry needs.

Community colleges and institutes of technology will probably become increasingly important in the training of supervisory and other specialist personnel, but opportunities should also be made available for the training of experienced employees. In the past, Canada has benefited immeasurably from the availability of immigrant craftsmen. This source has now greatly diminished. The training of their replacements and the provision of opportunities to Canadians to become construction craftsmen are a continuing responsibility. Although reductions in the volume of construction mitigate against recruitment and training during such periods, it is vital that training and retraining programs continue in order to meet future demands.

Moreover, to facilitate the mobility of manpower, it is most desirable that such training achieve standard minimum levels across Canada. The opportunities for improved training programs are enormous, and there is a great need to attract trainees and to facilitate their training.

Recommendation 8.3 That the industry and governments demonstrate greater interest in the initiatives taken by educational institutions to develop courses to meet the special needs of the construction industry by providing practical advice on curricula, assistance in the funding of courses and awards, and opportunities for employment.

Recommendation 8.4 That construction industry management and labour formulate plans with educational and training institutions to produce — with government assistance — training courses to a nationwide standard for construction supervisors and craftsmen, as already established in several trades under the "Red Seal" program.

8.2.5 Construction's Input to Design

Designers and contractors share a common heritage in the medieval "master builders", who undertook complete responsibility for both the design and the construction of a project. Over the years, the functions often became divided between the architects and engineers, who became responsible for design, and the builders, specialist contractors, and, more recently, general contractors, who assumed responsibility for construction. This division meant that contractors and suppliers did not usually contribute their expertise to the design phase, except informally.

Today the trend is reversing towards re-establishing a closer linkage between the two groups. Turnkey projects, heavy industrial work carried out by engineer-procure-construct firms, project management contracts, and projects executed by developers all involve a combined operation. The team approach is also encountered to varying degrees on other projects and is expected to become more widespread, aided by the use of computers to design, produce drawings and specifications, take off quantities, and develop lump-sum prices.

8.2.6 The Role of Microprocessors

The whole field of microprocessing (and indeed the new era of information technology) is expected to transform our society. It is even claimed that this new technology will bring a greater change than the industrial revolution. In construction, new management processes and techniques will emerge, and new and different craft skills will evolve from new and better equipment and materials. Canadian industry has an opportunity to be a leader in combining microprocessing with the design, construction, and operation of buildings.

8.2.7 Communication and Information Transfer

A lack of awareness of existing useful information is probably the greatest obstacle to progress. However, dealing with increasing volumes of information has become an almost impossible problem. Fortunately the computer appears to offer a solution, and the Canadian construction industry must learn to apply this new tool or be left behind by its competitors. It is expected that the computer will greatly reduce paper records on the job; the computer will be a data bank, a scheduler, a communications system, a copier, a design reference, and a source of technical and cost information. However, the continuing mutual adaptation of the construction process and the computer will not be easy: it will require a great deal of intellectual effort. Although computer training is now well integrated into the educational system, there is a real need to train construction managers and senior personnel in the selection and application of appropriate computer equipment.

Recommendation 8.5 That extraordinary efforts be made by the construction industry, government, and teaching institutions to establish a national capacity to develop and use appropriate computer software for application to design, management information systems, and the operation of buildings and industrial plants.

8.2.8 Industrial Projects

Scientific *research* is generally funded by governments and done by universities, major companies, or public or industry research institutes. The concept or technological *development* of an industrial project usually begins in response to a perceived marketable need and applies available research data from domestic or foreign sources. This development activity, inasmuch as it is linked to the market, is normally executed by the private sector. Even so, primary industrial project development is also done on a widespread scale by federal and — increasingly — by provincial government resource sector departments or crown corporations. There are many examples of such development activities in the industrial classifications of agri-fish-food, metal mining, hydrocarbons, and forest products.

These government departments appear to be increasing the effort made in development and reducing the proportion of the programs devoted to basic research. However, a common systems approach, which priorizes programs or evaluates the performance and results of such publicly funded programs, requires considerably more emphasis. Computers will no doubt be able to facilitate such comparisons in the future. The desirability of rationalization among the many R&D incentive programs was stressed by the Canadian Council of Professional Engineers in a recent report.[1]

The industrial project engineering design skills of the various engineering disciplines are evolving rapidly. The knowledge span of each is becoming narrower, with the result that the number of disciplines is growing. This creates more interface, which in turn must be effectively managed. The array of available materials, equipment, and machinery continues to increase rapidly. The transfer of technology, often on an international level, is increasing at exponential rates. To deal with such interfaces and complexities of choice, an owner may engage an EPC firm to manage, design, build, and commission the overall industrial project — that is, both its process engineering and construction engineering aspects — in a single contract package. This circumstance requires that the MEPC firm operate at the leading edge of the appropriate industrial technology, and it may well have its own R&D program to improve its competitive position in serving its clients.

There is a critical need in the Canadian construction industry to find new organizational structures, methodologies, risk-taking capability, and training and to make other changes that will achieve a substantially higher absorption of available technology. Available industrialized technology exists in areas such as CAD/CAM, robotics, microcomputers, prefabrication, modular techniques, and construction materials. Research into the factors that restrict the use of technology is needed. This research will also serve to guide further technical research and development.

The development and maintenance of an international competitive position for industrial projects require improved effectiveness in their use of capital. This effectiveness applies to both the export of the products of Canadian plants built by the construction industry at home and to the export of its expertise in technological and management services for plants built abroad. The key for such cost improvement will be technology transfer and its absorption; some sectors of the industry, however, will require restructuring for this absorption to take place.

Recommendation 8.6 That there be more industry participation in decisions within federal and provincial governments in establishing priorities for expenditures for development and demonstration programs and in the application of a modern systems approach to the evaluation of performance and results.

[1] Canadian Council of Professional Engineers, *Research and Development in Canada* (Ottawa: 1983).

Recommendation 8.7 That better recognition be given to the value of open technology transfer within, to, and from Canada in increasing Canadian productivity and international competitiveness.

Recommendation 8.8 That the federal government, with a cross-section of industry representatives having high-technology, management, and marketing skills, form a task force to examine industry initiatives to stimulate the development of technology in concert with government programs and research activities.

8.3 Who is Doing the Research?

8.3.1 The Report of the Sector Task Force

In the 1978 report by the Sector Task Force on the Canadian Construction Industry, it was noted that construction has, as an industry, conducted research and development work only on a limited scale.[2] Few firms sustain research establishments of any significance, and construction R&D, done mostly by governments, was estimated to account for only 0.16 per cent of total expenditures on construction.

It was further noted that many of the major construction companies operating in the international arena maintain, as a necessary and integral part of their operations, extensive scientific and empirically based R&D facilities. Such firms have, almost without exception, an enviable history of success in the conduct of large projects in both their home countries and internationally. In a recent editorial, the *Engineering News-Record*, referring to Japan, had this to say: "In construction they are tough competitors and they will remain tough competitors for a number of reasons. They are high tech. Their totally integrated big companies design and construct, but they also research and develop. Their R&D has produced some of the world's best in seismic design, railways, tunnelling, land reclamation."[3]

[2] Sector Task Force, *A Report by the Sector Task Force on the Canadian Construction Industry* (Ottawa: Department of Industry, Trade and Commerce, 1978).

[3] *Engineering News-Record*, October 21, 1982.

The report of the Sector Task Force stated that there appears to be a consensus among those knowledgeable about the practice of construction from both industry and government that a broadening of the research base, especially at the level of the individual firm, would enhance the knowledge system in the industry. This broadened base (such as exists in some other countries) would facilitate the transfer of technology to and within the industry.

Recommendation 8.9 That the construction industry be encouraged, through its associations or individual firms, to establish or expand in-house research activities; and that those associations with industry development funds devote part of the proceeds to research, development, and demonstration activities.

TABLE 8.1

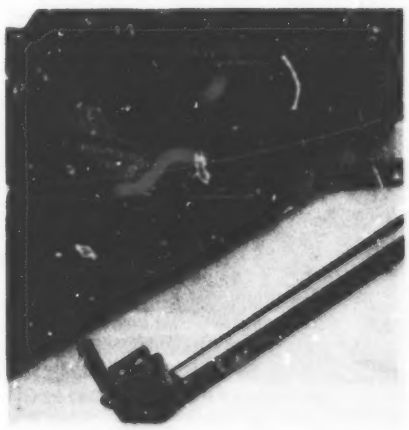
CONSTRUCTION-RELATED R&D IN CANADA. PERFORMING SECTOR AND TOTAL EXPENDITURE

	Per Cent of Total		
Sector	1967	1976	1980
Industry	24	36	30
Federal government	57	48	50
Provincial governments	4	3	6
Universities	15	13	14
Total	100	100	100
Total Expenditures	**1967**	**1976**	**1980**
Current dollars (millions)	18	42	52
Constant dollars (millions)	21.5	26.3	23.8

8.3.2 The Funding of Research

A recent analysis of available data by the NRC Division of Building Research showed that approximately $52 million was spent on building and civil engineering construction-related research in 1980.[4] This was almost a threefold increase since 1967, but when inflation is taken into account, the increase during these thirteen years was only about 11 per cent (less than 1 per cent each year). Table 8.1 shows that the largest supporter of construction R&D is the federal government, although its percentage support since 1967 has decreased, and the proportion provided by industry has increased. The largest share of industry expenditures on research is by manufacturers of materials and equipment used in construction.

A survey among selected members of the Conseil international du bâtiment (CIB) revealed a wide variation in expenditures on building research. Preliminary figures indicate that countries surveyed are spending on average about 0.2 per cent of their construction volume on R&D. Most countries reported that governments provided more than half of the research funds.



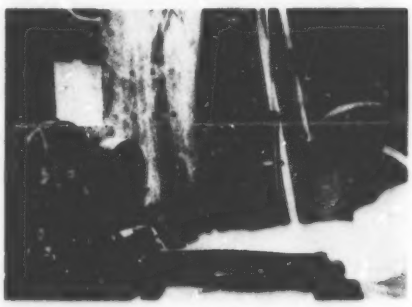
Recommendation 8.10 That governments recognize the importance of construction R&D; ensure that their research budgets keep pace with the ongoing needs of the industry (that is, the overall total is not less than 0.2 per cent of construction volume); ensure, through appropriate consultation, that this research is relevant to the needs of industry; and develop or expand joint programs with industry to encourage research in the private sector.

[4] A. S. Rakhra and A. H. Wilson, "Construction Research and Development" (Ottawa: National Research Council, 1982). (Unpublished.)

8.4 The Knowledge System

8.4.1 The Hutcheon Report

Superior knowledge is widely accepted as a key to industrial success. Technology is the science of the application of knowledge to practical purposes. In his 1974 report, *Research for Construction*, Dr. N. B. Hutcheon wrote: "The purpose of research for construction is ultimately the creation of knowledge. The understanding produced in the mind of the researcher must be translated into information and somehow transmitted and converted, with the aid of information systems, the educational system, and various scientific, technical and professional activities, into knowledge in the mind of the practitioner. Such a related group of activities in organization and support of a particular professional or specialist capability can be regarded as a knowledge system. Each discipline has its own knowledge system more or less distinguishable from others. It may now



be recognized that the owner, the designer and the contractor have a formidable communication and information problem. It results from the diversity of information they may require and from the very large number of sources that ought to be exploited. When the information required is strongly knowledge-related, the identification of what is available and likely to be helpful can be a formidable task which will increasingly be possible only with expert professional assistance. Such a capability may be directed toward the pre-selection of material to be held ready for retrieval in an information system. If, however, the need is of a kind that cannot be anticipated and served in this way, the expert assistance must be applied after the particular need is recognized."[5]

8.4.2 The Canadian Committee on Building Research and Other Vehicles for Interface

In developing a policy for construction technology, the knowledge system and its linkages are of paramount importance. Reasonably good mechanisms exist within specific professions and specific interest groups. What is needed are mechanisms that cut across existing boundaries and involve designers, builders, suppliers, and operators of buildings and other works. To help meet this need, the National Research Council set up a Canadian Committee on Building Research (CCBR) in 1975 "to provide an interdisciplinary forum for the stimulation and application of building science and technology in Canada, with particular reference to the design, performance and use of buildings".[6]

The committee concentrates on those areas of science and technology that are not now adequately served by independent associations and organizations. One of its first actions was to organize, in cooperation with other organizations, a Canadian Building Congress to explore multidisciplinary problems of wide interest. In 1982 the CCBR formed the Canadian Section of the CIB in an effort to identify and serve the information needs of those Canadians involved with the construction industry. More than 600 individuals joined the section in the hope that it would provide access to national and international research and technology related to building.

Within the industry, there are a number of national organizations whose primary purpose is to foster R&D and the transfer of technology and facilitate an excellent interface among interested parties. Examples include the Roads and Transportation Association of Canada, the Canadian Electrical Association, and councils or associations representing product groups such as concrete, steel, asphalt, and wood. Relatively speaking, however, there is little contractor involvement in such activities.

Recommendation 8.11 That a concentrated effort be made by all sectors of the construction industry to increase their interface with one another on technical matters and that a special conference be convened for major associations and senior officials of government to develop appropriate means of achieving this interface.

8.4.3 The Canadian Construction Management Development Institute

The Canadian Construction Management Development Institute (CMI) was established in 1981 as a means of publicizing existing construction management educational and training courses and facilities as well as stimulating and initiating new activities in this area.[7] This action was advocated by the CIDC and is financed by government and industry (Canada Mortgage and Housing Corporation, Industry, Trade and Commerce, Public Works Canada, Canadian Construction Association, and Housing & Urban Development Association of Canada).

Recommendation 8.12 That the sponsors of the Canadian Construction Management Development Institute be urged to continue their financial support as a means of upgrading the technical capability of the industry.

[5] N. B. Hutcheon, *Research for Construction A Report Prepared for the Consideration of the National Research Council of Canada* (Ottawa: National Research Council of Canada, 1974), pp. 3-4.

[6] Associate Committees' Secretariat, *Activities of Associate Committees 1982-83* (Ottawa: National Research Council of Canada, 1983), p. 98.

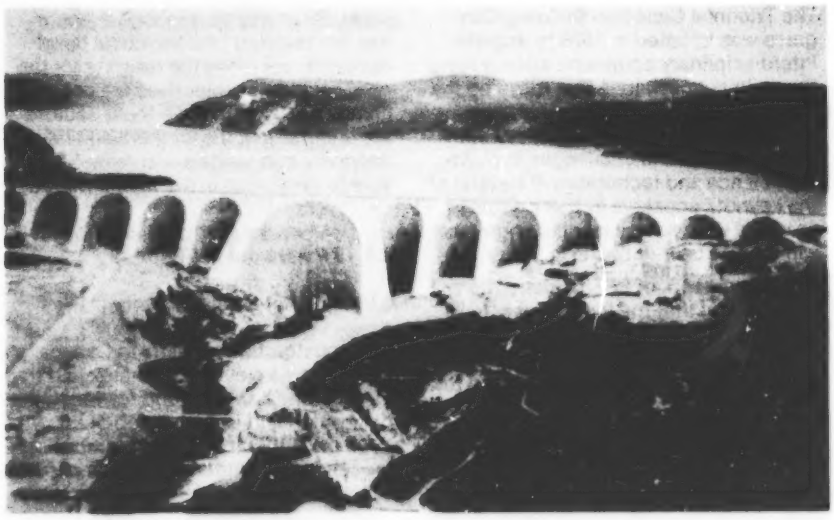
[7] Construction Industry Development Council, *1980-81 Annual Report* (Ottawa: 1981).

8.4.4 The Interdepartmental Committee on National Construction Research, Development and Demonstration

In 1981, a federal Interdepartmental Committee on National Construction Research, Development and Demonstration was established under the auspices of the Ministry of State for Science and Technology. The committee is analysing the current state of construction RD&D supported by the federal and other levels of government and the private sector and is assessing how this meets national needs. The committee will recommend objectives and priorities leading to the improvement of the construction process through RD&D and will recommend policies and mechanisms to meet these objectives and priorities. A good many members of the CIDC and of the construction industry as a whole responded to the questionnaire on construction RD&D distributed in connection with this study.[8]

8.4.5 The Economic Council of Canada

In mid-1983, the Economic Council of Canada (ECC) issued a report, *The Bottom Line*, following its study of the factors contributing to the situation in which "productivity growth has sunk to a rate so low that it has no historical parallel at all".[9] It is significant that well over half of the body of the report dealt with the role of new technology in improving productivity and living standards. Its principal recommendation was that federal and provincial governments give greater emphasis to assisting the transfer of technology. Supporting recommendations included those advocating that trade associations adopt as a primary responsibility "the collection and dissemination to member firms of information on new ideas and best-practice technology and management



methods";[10] that government financial assistance be provided to this end; and that there be a specific program to increase the transfer of scientific knowledge from the universities to industry.

Recommendation 8.13 That the federal government continue to examine the state of construction RD&D and take appropriate action to facilitate both the development and dissemination of technology in the construction industry.

8.5 An Assessment of the Industry

8.5.1 Industry Volume

Construction is an important industry that has played a key role in the development of Canada. The annual volume of domestic construction is equal to about 16 per cent of GNP, roughly the same as for Sweden. This greatly exceeds the shares reported for the U.S.A. and West Germany, at about 8 per cent each, and France and the U.K. at 10 per cent.[11] Inasmuch as one dollar in six spent for end products or services goes for the purchase of construction, it is important that a quality product be produced at a reasonable price. Further, there is likely to be continuing excess capacity in the industry that will be available for foreign work.

8.5.2 Achievements

The Canadian construction industry has excelled in the construction of transportation facilities such as railways, highways, and airports and in hydroelectric schemes and other civil works. It enjoys leadership in construction in and for cold regions and in the use of wood framing, flying forms, and explosive welding. The industry has perfected sealed glazing, the open rain-screen principle, and protected membrane roofing to reduce the effects of temperature variation and rain penetration on building frames and fabric. The prefabrication of large cladding panels following rain-screen principles is being perfected. These techniques are exportable.

Recommendation 8.14 That the federal government and industry representatives develop a strategy to exploit advanced Canadian construction technology for foreign markets.

8.5.3 Coordination and Communication

As international opportunities open up, the Canadian construction industry will require more sophisticated training and better coordination. It will be competing with industries from countries that have national ministries of construction with coordinated technical and financial support programs. Canadian companies are unlikely to do well internationally without a similar organizational structure.

[8] Revay and Associates Limited, *Construction R.D.&D. in Canada — Present and Potential* (Ottawa: 1983).

[9] Economic Council of Canada, *The Bottom Line — Technology, Trade, and Income Growth* (Ottawa: Supply and Services Canada, 1983).

[10] *Ibid*, p. 139.

[11] "1981 Domestic Construction Statistics and 1980 International Construction Statistics", *Constructor Magazine* (January 1982).

The Triennial Canadian Building Congress was initiated in 1976 to improve interdisciplinary communication among the various specialties that make up the construction industry. The third congress, held in October 1982, dealt with achievements and challenges in building science and technology.[12] Several of the keynote speakers at that congress provided wise advice on challenges that will have to be met by the industry.

J. D. Thompson, of PCL Construction Ltd., warned that the industry will have to produce a better product at less cost if owners are going to be able to afford to build new projects. He suggested that to reduce costs, the total time for design and construction must be compressed and that this can be achieved by the team approach, where the contractor is appointed at the same time as the designer and works on a team with the owner to achieve his schedule and budget objectives.

R. F. Shaw, of Montreal Engineering Co. Ltd., pointed out that fragmentation in the building industry has resulted from beneficial and rapid advances in technology; as a result, overall coordinating efficiency is suffering. He suggested that we need "a master of building construction" who has taken degrees in engineering and architecture, combined with business administration. These qualifications, plus training on the job and in the office under enlightened management, will produce "professional constructors".

Dr. Larkin Kerwin, President of the National Research Council of Canada, noted the great progress we have made in our scientific knowledge but stated that our present problem is to communicate this knowledge to builders who can apply it. He went on to suggest that a building must be much more than a material shell; it must possess a spirit. In other words, it must provide an environment that enhances rather than inhibits the productivity of its occupants.

Perhaps the greatest challenge in the decade ahead is to improve understanding between labour and management. By and large, organized labour has not resisted new technical developments, but often the reasons for the change and the objectives are not clearly explained. When these factors are understood, the workers on site are generally cooperative and more fully able to take pride in the final product.

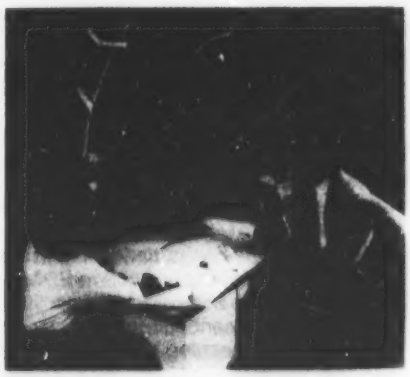
8.6 What about the Future?

8.6.1 A Vulnerable Industry

The construction industry in Canada is a giant one, as well as a complex and fragmented one, in which and for which the generation and transmission of knowledge are difficult and often frustrating processes. By international standards, it is a skilled and efficient industry; it is nevertheless vulnerable to competition both at home and abroad. In 1982, the value of construction put in place was some $55 billion. More than almost any other industry, construction is faced with cycles of boom and bust. In 1981, the greatest problem was to find skilled people for construction. A year later there was a surplus. The material needs of the world as a whole are not decreasing; it is therefore fully expected that the demands for new construction, for the repair and renovation of existing built facilities, and for the provision of the infrastructure required for the exploitation and transportation of natural resources will increase again.

A number of factors in the present situation serve to inhibit the performance of adequate R&D by and on behalf of the construction industry. These include

- the complexity and diversity of the industry and its products
- the lack of effectiveness in the transfer of research information to practice
- the limited focus of federal support for construction-related research and its transfer to practice
- the yet-unmeasured influence of the regulatory system in Canada
- the uncertainty in the long-term economic outlook for large sections of the industry
- the incorrect view that all of the new technology required is already available.



8.6.2 Challenges

A number of areas in which new technology for construction should be focused in the future can be identified. These include energy conservation; the quality of the environment; the rehabilitation, renovation, or restoration of buildings; marine works; natural gas production; the application of computers in the construction process and its management; the improvement of on-site productivity through technology; and multidisciplinary work on economic, legal, regulatory, and other impediments to the more effective functioning of the industry.

It will be easy to meet these challenges if communication barriers can be broken. A project to study the building construction process in cooperation with owners, designers, contractors, and suppliers during a three-month period in 1980 was an outstanding success.[13] It led to the idea of "building clinics", in which a small team of building scientists visit designers in their offices to explain how up-to-date technology can be applied on current projects. This is technology transfer at work. It is inhibited, however, by a shortage of people in industry with training in building science.

The remedy for this situation is an imperative that must receive greater attention than in the past. The keys to success in construction technology in the decade ahead are communication, cooperation, and coordination.

[12] *Proceedings of the Third Canadian Building Congress* (Ottawa: National Research Council of Canada, 1982).

[13] R. L. Quirouette, *A Study of the Construction Process* (Ottawa: National Research Council of Canada, 1982).

9 Construction in Remote Regions

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Annex A: CIDC Questionnaire on Construction in Remote Regions

9 Construction in Remote Regions

9.1 Introduction

As the demand for Canada's natural resources increases, so too will the number of development projects in the North and other relatively isolated regions of the country. The pace and scale of this resource development may now be uncertain, particularly in view of current world economic conditions, but these projects will likely be undertaken at some time in the future. Oil, natural gas, mining, and hydroelectric-related projects will take place, and transportation projects, such as pipelines, roads, railways, bridges, harbours, and airports will be built. Construction and permanent camps will be put in place. Expansion and improvement of existing communities will take place, and new towns may be built. All these projects must be undertaken in such a way as to minimize any adverse effect on the fragile environment and on the indigenous peoples of the area. Work on these projects could, in fact, benefit the northern peoples, for it would enable them to interact with southern technology and the southern way of life.

The potential for northern construction is impressive, and Canada's construction industry must be prepared to plan, design, and build a wide variety of structures appropriate to the conditions encountered and remote from the normally available pools of manpower and material supplies.

9.2 The CIDC Study Group's Terms of Reference

As an integral part of its study on the decade ahead, the CIDC established the Study Group on the Special Conditions Relating to Construction in the High Arctic and Other Isolated Regions. The mandate of this study group was

1. to study the effect of legislation and regulation in the areas of taxation, working conditions, and environmental protection vis-à-vis the recruitment of employees, the operation of construction projects, and capital costs of construction work in isolated regions
2. to study the effect of provisions governing the hours of work, living conditions, and trade jurisdictions in labour agreements in relation to the execution of construction projects in isolated regions
3. to recommend courses of action designed to facilitate the execution of such projects in an acceptable fashion that recognizes the exceptional conditions existing on such projects.

All members of the study group have been involved at one time or another in the construction of a wide variety of projects in remote areas. However, to bring a more comprehensive perspective to its task, the committee also sought the views of a cross-section of other experienced individuals. This was achieved by addressing a questionnaire (see Annex A) to a large number of construction contractors, union representatives, owners or sponsors, utilities, and government officials. The responses to this questionnaire were recorded and analysed in detail. The report of the study group is based in large measure on the replies received, in addition to the experiences of the study group members.

9.3 The Development of the North and Other Remote Areas

Resource-related activities in the North and other remote areas have increased dramatically over the past ten to twenty years. The Canadian North, the northern reaches of the provinces, and other remote areas look poised for an extended period of resource development, given a turnaround in the world economic environment. Yet conflict among the uses of land for non-renewable resource development, traditional native pursuits, and environmental preservation is likely to intensify unless appropriate actions are taken.

Construction, mining, and other industrial activity in cold and remote regions are subject to a variety of problems not encountered normally in the more southerly regions of Canada. Although significant advances of a scientific, technical, and even social nature have been made in recent years, much work in these and other areas remains to be done.

Responses to the study group's questionnaire showed clearly that economics, that is, the normal laws of supply and demand, should govern resource development. However, a large proportion of Canada's reserves of minerals and hydrocarbons are located in remote

areas of the country and offshore, where the climate is unfriendly and the environment fragile, where the population base is small and the infrastructure usually minimal. Development of these resources will therefore be difficult and costly. Many considerations, such as communications and transportation, land use, and the environment, fall within the control or sphere of influence of the public sector, not private industry. There are times when government action may, in fact, distort normal market signals. However, responses to the questionnaire generally agreed that public encouragement and support are and will continue to be required if the benefits of remote-site resource development are to accrue not only to the peoples living in the remote locations but also to all Canadians.

Recommendation 9.1 That governments cooperate to establish a clear and comprehensive policy on construction activities in the North and remote areas with stated objectives to assist peoples in remote areas and to upgrade the program of services available in these regions.

Recommendation 9.2 That governments, as part of a national industrial policy, cooperate to formulate and implement a uniform approach in the development of resource industries and all of the necessary infrastructure.

It is generally believed that more positive thinking on the part of the government and the development of such a program would help create an environment more conducive to investment, stability, and orderly growth.

In addition to providing and undertaking a wide range of services and infrastructure projects, the government should provide assistance and support in other areas to alleviate the higher risks involved in northern and remote-site development and to assist the local peoples. Long-term planning will be essential to sustain additional development and continuity of communities. Survey respondents agreed that government support was necessary and proposed, in particular, preferential interest or tax rates or both, greater use of the Canadian Armed Forces, better skills training programs, settlement of native claims, and government equity in projects. It was also proposed by some that all projects in remote areas be undertaken as joint ventures with northern companies and with northern peoples.

The native population in the North and in remote regions is too small and too dispersed geographically to meet the potential labour requirements in these areas. In addition, barriers — such as lack of employment skills and social and cultural structures — continue to exclude many native peoples from the option of non-traditional employment. Effective education and training programs have to be developed if the native peoples are to be brought into the mainstream of economic activity.

Recommendation 9.3 That a conscious and concerted effort by native groups, industry, organized labour, and governments be directed to the development of education and training programs to meet native needs and to encourage native participation; that all parties be encouraged to continue the practice of preferential employment of bona fide northern residents qualified to perform the work; and that preemployment training, apprenticeship, and on-the-job training facilities be expanded to permit increasing numbers of northerners to be trained in the construction trades.

9.4 Legislation and Regulation

9.4.1 Taxation

Members of the study group, together with 70 per cent of the survey respondents, identified taxes as an important inhibiting factor to the development of projects in remote areas. There was a consensus that tax incentives for individuals and corporations would stimulate this development. Remote areas frequently present a hostile environment, and costs are commensurately high. It is believed that tax rates for both corporations and individuals should reflect these factors. The survey showed widespread support for incentives relating to northern allowances, remote-site or isolation benefits, room and board, and rotation of the work force. Moreover, the existing sales tax rate on materials, supplies, and major equipment used in remote areas should be lowered as a means of reducing the overall costs of projects. The survey also proposed that project sponsors and contracting firms should be provided with specific tax benefits similar to those offered to the hydrocarbon industry.

Recommendation 9.4 That the federal government's present intention to tax northern allowances be permanently rescinded.

Recommendation 9.5 That the federal government recognize that high costs will remain a fact of life in the North and other remote areas; and that the government enact tax measures that will encourage development and attract a skilled work force.

9.4.2 Employment Standards and Conditions

Responses to the questionnaire showed that contractors were evenly divided about whether or not present employment standards and conditions inhibited development of remote sites. Some maintained that southern Canadian standards were economically unworkable in the North and that new regulations should be developed to recognize the problems peculiar to the region. These regulations should be set realistically for each type of project and include preferential employment clauses for local residents. Others indicated that standards should remain high and that ways must be sought to encourage and assist northerners, recognizing that skills cannot be fully developed on a single project.

More than three-quarters of the responses from union officials indicated that present standards and employment conditions did not hinder development. Standards should remain sufficiently high to permit only qualified workers on the projects and to maintain high levels of health and safety conditions. One official put forward the idea that a tradesman be skilled in a number of parallel trades and be allowed to receive his normal salary while performing a less skilled function.

Other respondents seemed to agree that inasmuch as the North is still frontier and it is difficult for local residents to get work, standards and conditions adapted from southern legislation should be relaxed.

Recommendation 9.6 That authorities recognize that employment conditions in the North demand special treatment not necessarily required in the more developed southerly regions; that employment standards and conditions be tailored to northern requirements to achieve maximum use of manpower; that recognized apprenticeship programs in indentured trades not be diluted; and that skill standards must be maintained for safe and efficient completion of construction projects.

9.4.3 Environmental Protection

Almost all respondents agreed that protection of the fragile environment in the North and in other remote locations was essential. Roughly two-thirds of those responding expressed the view that regulations were too strict and that environmental protection studies were too long, too involved, and too costly and adversely affected the pace of development. Those respondents saw a need for a better balance between development and the environment and for improved coordination among the many departments, agencies, and review panels involved in protecting the environment. The remaining respondents did not see the present legislation as oppressive and indicated that the environment should not be sacrificed for development. There was general agreement that each project should be judged on its own merits and carefully monitored to ensure compliance.

Recommendation 9.7 That a unified and coordinated approach to environmental protection be established, serving both the need for the development of economic resources and the protection of the natural environment; that neither requirement be given precedence over the other; and that a comprehensive cost-benefit impact study be developed as early as possible for each major construction project.

9.4.4 Other Areas

Twenty-five respondents pointed out other areas of legislation and regulation that they deemed inhibited development. Many of these comments were on different aspects of labour relations. A number of contractors thought the various labour relations acts were out of tune with the realities of remote regions and that fringe benefits and standards imported from southern Canada were costly to implement in the North. Union representatives proposed better legislation and regulations for workers in remote areas and a better delineation of the responsibilities for labour relations of the various levels of government. Other proposals dealt with the need for an economic climate conducive to resource-based investment, changes to certain provisions of the National Energy Program, settlement of land claims, preferential treatment for local contractors, and the need for more joint ventures with southern Canadian firms.

Recommendation 9.8 That governments and the private sector work towards the creation of an economic environment for Canada that will be conducive to a rational and effective development of the resource-based industries in remote regions.

9.5 Logistics and Weather Conditions

Ninety per cent of all respondents were of the opinion that the North should not be left in its present relatively undeveloped state. One respondent summed up the feelings of many, however, when he stated that "the resources in the North represent our legacy to future generations. We are responsible for ensuring that their potential is maximized in a rational, environmentally and socially responsible way." Those who thought the North should remain undeveloped suggested that the projects would be uneconomic and resisted by the native peoples, that the environmental effect of certain projects might not be acceptable, and that greater benefits would accrue to all Canadians from equivalent investment in southern Canada.

By a 2:1 ratio, respondents favoured a faster, more imaginative approach over a slower, evolutionary type of development of the North and remote areas. However, many respondents qualified their answers. Whether in favour of slower or more rapid development, the prevailing view was that market forces should dictate the pace and that improved planning and coordination, primarily among governments, were required to overcome concerns for environment and native peoples. Those in favour of more rapid development viewed it as a means of overcoming ever-increasing project costs and of creating much-needed employment. Some felt that the lack of infrastructure would hinder development. Others suggested that stagnation would bring about severe social and political problems and favoured more imaginative development. It seems generally agreed that native northerners must be involved in these development activities.

Recommendation 9.9 That the comprehensive plan for northern development urged in Recommendations 9.1 and 9.2 respond to the needs of the indigenous population and protection of the environment, but nonetheless to the ultimate realization of the vast potential of the region; that it be recognized that it will not be acceptable to permit the area to develop without the establishment of appropriate policy guidelines; and that the federal government take the lead role and involve all other levels of administration.

9.6 Labour Agreements and Working Conditions

9.6.1 Labour Agreements

As might have been expected, the twenty-four union representatives who responded to the questionnaire were in favour of labour agreements, for they ensure that workers have health and welfare benefits, pensions, and adequate living and working conditions. From respondents who did not favour or who were only partly in favour of labour agreements, there were suggestions that such agreements were normally developed in southern Canada and added considerably to the costs of northern or remote-area projects. They contended that the market place should dictate working conditions and pay scales. The high cost of mobilization, the lack of adequate pools of labour, the short construction season, and requirements for native training appear to make sophisticated labour agreements impractical. Other respondents indicated that some ground rules were necessary for the protection of both employers and employees, whereas still others saw labour agreements as preventing able and willing local workers from benefiting from construction and other development projects.

Recommendation 9.10 That labour agreements not be imposed on the development of the North, but be the result of negotiations between employers and unions; and that basic conditions appropriate to labour agreements in remote areas be established by legislation.

Union members of the study group proposed an addition to this recommendation that was not agreeable to the other members. The proposed addition reads: "That the federal government's 'fair wage' policy applicable to government-sponsored projects should also include the construction industry's health, welfare, and pension contributions as part of the 'fair wage' contract conditions in bid documents."

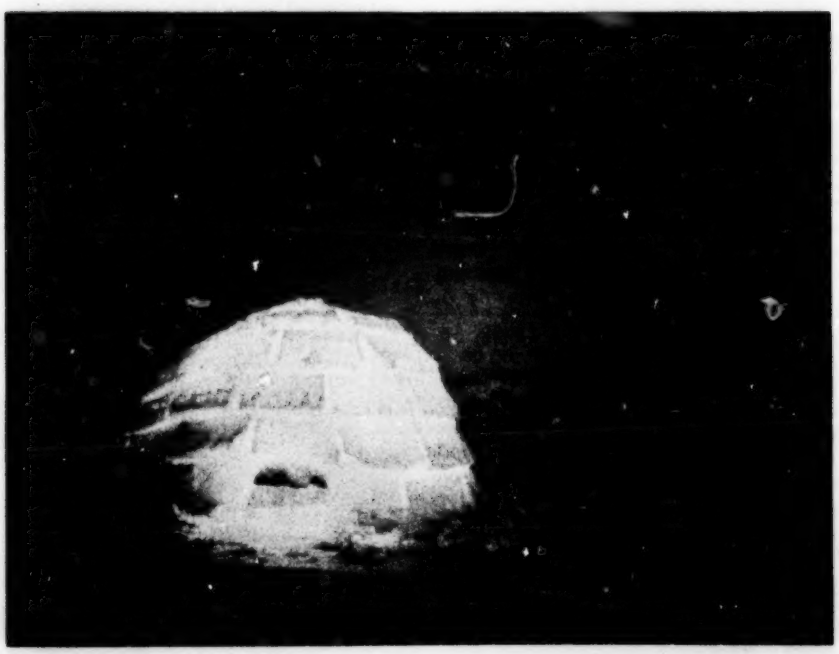
9.6.2 Transient versus Local Labour

The questionnaire also sought the view of respondents on rates of pay and other conditions as they applied to transient and local workers. Three-quarters of the replies indicated strong support for equal pay for equal work and the application of the same wage structure and conditions of work to all workers, whether transient or local. Others stated that although pay scales should be identical, different travel and board arrangements should apply to transient workers — which still others thought would be a form of discrimination against local peoples. The need to develop the local peoples and to train them to appropriate levels was stressed by many of the respondents.

Recommendation 9.11 That the concept of equal pay for equal work be accepted and discrimination against the indigenous population be prevented; and that travel and living allowances be accepted as a means of overcoming the resistance to mobility of the work force.

9.6.3 Incentives

Eighty-six per cent of the respondents expressed the view that special incentives were necessary to encourage mobility of workers for projects in the North and other remote regions. It was generally agreed that without such incentives, the special skills required in the North would not be available. Some of the incentives mentioned include tax exemptions or lower rates of taxation for companies and for individual workers to cover travel, accommodation in the area of work, and the higher cost of northern living; family accommodation wherever possible and housing allowances if a town site is constructed; longer hours of



work and overtime pay; good communications; periodic leave; good working conditions; and the issue of seasonal clothing on a buy-back basis. A few respondents saw no need for such special northern allowances at the present time because of high unemployment in southern Canada.

9.6.4 Types of Incentives

Respondents were also asked which incentives they would recommend for the North and other remote sites; the results are shown in Table 9.1.

TABLE 9.1
RESPONDENTS' VIEWS ON INCENTIVES

Incentive	Per Cent for	Per Cent against
Longer work week	89	11
Shorter work week	4	96
Higher wages	48	52
Project premiums	72	28
Extra paid holidays	45	55
Periodic R&R trips	93	7

One respondent saw all such incentives as a discouragement to residency in the North and to the employment of local residents. Others felt that incentives should be as attractive as possible to attract qualified workers but should depend on the nature, location, and duration of the particular job and the season of the year. The rotation of workers' families was suggested as a novel approach, instead of the traditional incentives as discussed above.

9.6.5 Composite Crews

Eighty-two per cent of all respondents favoured the trend towards composite crews and multiple-craft work assignments. They found that restrictions on work assignments and narrow limits of jurisdiction tended to reduce productivity and add to costs, thus making Canadian industry less competitive.

Although the majority of union representatives did not favour this particular approach, others were of the opinion that composite crews and multiple-craft work assignments might be advantageous for small and medium-sized projects, but unnecessary for large projects.

9.6.6 Other Incentives

Other suggestions for incentives to the work force included good wages and good living conditions with single-room accommodation, good and plentiful food, and health, recreational, and entertainment facilities (satellite TV, telephones, cultural and trade education programs). In effect, a home away from home. Also frequently mentioned were tax incentives, northern benefit allowances, improved pension benefits, and more flexible unemployment benefits to fit the northern situation. For southerners, it was felt that there should be special information sessions on northern living. There should be greater emphasis on training and hiring of northerners. Ideally, native northerners should be allowed time off to fish and hunt. Mentioned also were training to higher skills, local labour quotas, guaranteed hours of work, the supply of warm winter clothing, labour-management meetings to discuss the work place, incentives for productivity, and bonuses for project completion.

It would appear that there are no clear-cut answers about the best method of training and upgrading the skills of the local work force. Different skills require different approaches, and the choice of training method is contingent on the size, location, and duration of the project and the availability of local skills. Whereas some forty per cent of the respondents appeared to favour on-the-job training, others found other methods also appropriate.

Recommendation 9.12 That government, owners, and the construction industry adopt a pragmatic approach to incentives designed to attract workers to remote construction sites and that the approach be consistent with general current conditions and those pertaining to the project in question.

Union representatives on the study group proposed that the following be added to Recommendation 9.12: "Contractors and unions should continue their efforts towards maximum use of skilled manpower as one of the methods to improve productivity." Contractor members were not in agreement with the proposed addition, however, and the sentence was not included in the recommendation.

The National Research Council of Canada has proposed establishing a research centre in Western Canada that would coordinate and support the R&D efforts of industry, universities, and government needed to sustain the growth of Canadian engineering and construction capability in cold regions. The proposed centre would become involved in monitoring the performance of engineered structures and buildings, developing instruments and other tools to evaluate sites, studying the cold-weather performance of equipment and the interaction between people and equipment, designing a set of codes and standards specifically to meet northern standards, and acting as a major source of technical information. It is planned that divisions of this organization will be physically located in Yukon and the Northwest Territories. The La Grande area in Northern Quebec is the scene of considerable construction activity and has excellent existing infrastructure conducive to the establishment of a research centre.

Recommendation 9.13 That a Centre or Centres for Cold Weather Construction Research and Development be established as soon as possible in order that the Canadian construction industry and its clients may benefit from the knowledge developed.

Annex A
CIDC Questionnaire on Construction in Remote Regions

Construction activities in northern Canada and other remote regions are influenced by:

A — The Marketplace
The marketplace establishes the need and desirability for construction projects of all types. Social development is equally a major influence in this area.

B — Legislation and Regulations
Legislation and regulations at various levels of government — federal, provincial/territorial, regional and local — produce control mechanisms as well as stimuli.

C — Logistics and Weather Conditions
Logistics and weather conditions generally add significantly to the cost of construction in the North and are major considerations in the overall economic evaluation of any project.

D — Labour Agreements and Working Conditions
Labour agreements and working conditions generally establish the incentive for the migration of the work force to northern projects and accordingly are very important in the assessment of the overall viability of the undertakings.

The following questions are designed to elicit your views and opinions on these subjects. *Please answer each by circling your choice. Please elaborate on any point, or add additional comment, whenever you feel this will help the Study Group to understand and appreciate your views.**

A — THE MARKETPLACE

1 - In a private enterprise society, the laws of supply and demand in an open marketplace generally govern development. Do you feel that the North is susceptible to development in this fashion?

Answer - a) Entirely b) Partly
c) Not at all

Comment:

2 - If you answered b) Partly; or c) Not at all to A-1, could you outline briefly what other influences you feel would enhance development, and why.

B — LEGISLATION AND REGULATIONS

Legislation and regulations generally emanate from three sources: federal, provincial/territorial and municipal governments.

Is there specific legislation and/or regulation in the following areas that you feel inhibits development of projects in remote areas?

1 - *Taxation*

Answer - a) Yes b) No

Comment:

2 - *Employment Standards and Conditions*

Answer - a) Yes b) No

Comment:

3 - *Environmental Protection*

Answer - a) Yes b) No

Comment:

4 - *Other Areas*

C — LOGISTICS AND WEATHER CONDITIONS

The topography, distances, isolation, lack of communications, and adverse weather conditions all work against development in the North.

1 - Do you feel that the North should remain in its present relatively undeveloped state?

Answer - a) Yes b) No

Comment:

2 - If you answered "No" to C-1, would you favour a) a slower paced evolutionary development or b) a more imaginative, larger-scale and faster development?

Answer - a) or b)

Comment:

D — LABOUR AGREEMENTS AND WORKING CONDITIONS

Sophisticated labour agreements and working conditions are generally associated with large-scale developments, whereas small projects are frequently completed on a much more informal basis.

1 - Do you favour the labour agreements approach to construction projects with prescribed hours of work, living and working conditions, trade jurisdictions, etc.?

Answer - a) Yes b) No c) Partly

Comment:

2 - If you answered "Yes" to D-1, would you prefer the same rates and conditions for transient and local workers; or different ones?

Answer - a) Same b) Different

Comment:

* From six lines to a half page of space was provided throughout the questionnaire for comments.

3 - Do you feel that special incentives should be provided to encourage mobility of workers to projects in the North and other remote areas?

Answer - a) Yes b) No

Comment:

4 - If you answered "Yes" to D-3, would you recommend

a) Longer work week
Answer - Yes No
b) Shorter work week
Answer - Yes No
c) Higher wages
Answer - Yes No
d) Project premiums
Answer - Yes No
e) Extra paid holidays
Answer - Yes No
f) Periodic R&R trips
Answer - Yes No

Comment:

5 - There appears to be a trend towards composite crews and multiple-craft work assignments on northern projects. Are you in favour of this approach?

Answer - a) Yes b) No

Comment:

6 - Do you have any other suggestions for work force incentives?

Answer - a) Yes b) No

Comment:

7 - The training and upgrading of the local work force is one of the benefits of northern development. This can be accomplished in a variety of ways, including the following:

a) On-the-job training
b) At established training facilities in already developed areas
c) At newly created training facilities in regional centres in the North
d) At training facilities to be established at the project areas.

Please circle a), b), c) or d) as your choice.

Comment:

E - ANY ADDITIONAL COMMENTS

_____

Signature

NAME AND ADDRESS (Please print or type)

Name: _____

Organization: _____

Address: _____

_____

10 The Report of the Major Projects Task Force

10.1 Introduction

10.2 The MPTF Inventory of Major Projects

10.3 MPTF Recommendations Supported

- 10.3.1 The Major Projects Assessment Agency
- 10.3.2 Canadian Participation in Major Projects
- 10.3.3 Reviews of the Regulatory Process
- 10.3.4 Certification and Licensing Requirements
- 10.3.5 The Mobility of Manpower
- 10.3.6 Technology
- 10.3.7 Procurement Policies
- 10.3.8 Canadian Standards

10.4 MPTF Recommendations Warranting Revision

- 10.4.1 Regional Equity
- 10.4.2 Timing
- 10.4.3 Employment and Manpower
- 10.4.4 Technology
- 10.4.5 Foreign Trade
- 10.4.6 Preferential Premiums
- 10.4.7 Standards: Implications for Exports
- 10.4.8 World Product Mandates
- 10.4.9 Marketing Excess In-house Capacity

10.5 Areas of Concern

- 10.5.1 Productivity
- 10.5.2 The Benefits of Major Projects
- 10.5.3 Canadianization
- 10.5.4 Regionalization
- 10.5.5 Changes in the Industry
- 10.5.6 Economic Effects

Annex A: Research Topics Related to the Execution of Major Projects

Annex B: Findings and Recommendations of the Major Projects Task Force

10 The Report of the Major Projects Task Force

10.1 Introduction

The report of the Major Projects Task Force (MPTF) was published in June 1981. It was the culmination of efforts by a combined task force of owner or sponsor, business, and labour representatives, under the joint direction of Mrs. Shirley Carr and Mr. Robert Blair. It examined major projects in Canada and their effects on the nation and made a series of recommendations directed at gaining maximum benefits for Canadians from them. The implications of these recommendations and of their implementation is of critical importance to the construction industry.

The CIDC has long had a deep interest in the effect of mega projects on the overall construction program and of maximizing Canadian participation in their various phases. The CIDC Standing Committee on Canadian Content and Capability was formed in 1976; made recommendations, including the establishment by the federal government of a national review board on major projects; and sponsored a conference in Edmonton in 1978 on the industrial benefits of major projects. Six members of the CIDC were appointed to the MPTF and actively participated in its work.

The assignment of the CIDC Study Group on the Major Projects Task Force Report was to review the report's contents and to prepare a response from the perspective of the CIDC. The review centred on the two major components of the report — that is, the inventory of major projects and the recommendations — and consists principally of a response to the inventory and of a reaction, both positive and negative, to the recommendations, plus an additional segment on important issues raised during the course of the work.

As will be discussed in some detail, the inventory of projects was considered deficient in investigation, methodology, and definition of the magnitude of anticipated major project activity. However, although appearing to be based on the inventory, the recommendations of the MPTF report stand as well on their own merit, and the study group has responded to them in that light.

10.2 The MPTF Inventory of Major Projects

The compilation of an accurate inventory of projects is clearly a difficult task for many reasons. The study group concluded that the inventory listed in the task force's report is highly inaccurate about the total volume of projects planned and has considerable potential to mislead the reader. The major deficiencies identified by the study group are the following.

- First, the report fails to distinguish between projects that are classifiable as annual maintenance expenditures and those that are additions to production capacity, new plant, or projects intended to create or improve infrastructure. Although expenditures on maintenance projects may be substantial, the overall effect of new projects is substantially different.
- Second, the report does not appear to make any attempt to correlate proposed projects with projected market demands and economic factors crucial to the decision of whether or not to proceed. For example, four proposed plants may appear in the inventory and their costs and manpower requirements in totals, but the market demand justifies building only one of them.
- Third, the report deals with all planned projects on an equal basis, failing to consider probabilistic factors or to use a sensitivity analysis.
- Fourth, as a result of especially the second and third deficiencies, there is a high degree of duplication of projects directed to the same resource development or market. In many instances, these projects will in fact be competitive with one another, and the probability of the full list being completed is extremely low.
- Finally, the report uses a variety of methods for reporting project cost, leading to widely divergent estimates.

When simple addition is used to sum the number of projects, their costs, their manpower requirements, as well as the other effects associated with major projects, the study group feels that major distortions of information occur. This distortion of the potential of major projects and their effect on Canada may well have resulted in misleading expectations for many readers.

Insofar as the MPTF recommendations are based upon the data contained in the inventory, the distortions and inaccuracies contained in it will correspondingly affect the recommendations. In fact, as will be discussed later, the study group found itself in agreement with many of the recommendations in the report. But that agreement was arrived at on the basis of a knowledge of the industry, without regard to the inventory. The study group believes that the validity of the recommendations could be substantiated through the compilation of more accurate information.

Comprehensive, accurate, and validated information on an inventory of major projects would be of great benefit in many ways to both government and private industry. However, there are significant problems in both the gathering and dissemination of the data that would need to be overcome. Particularly important is the protection of private information. In industry, this protection may mean protecting data that are essential to corporate plans and strategy or that might affect competitive positions. In public activities, the same importance may be attached to data that would have political significance. The issue is one of trust in the agency gathering the data and its methodologies.

Recommendation 10.1 That an early start be made on the systematic gathering and dissemination of pertinent information on the demand for services, material, equipment, financing, and labour for major projects; that these inventories be conducted by a non-governmental agency that can ensure confidentiality; that inventories be gathered and defined according to a known and agreed set of criteria and analysed in as sophisticated a manner as possible; that inventories be current; and that as a minimum, totals in categories be presented as probabilistic ranges.

10.3 MPTF Recommendations Supported*

Members of the study group brought to the discussion many years of experience with the construction industry from a variety of perspectives. From this background, there resulted substantial agreement with the recommendations of the task force's report in spite of the inaccuracy of the inventory's data. *The study group urges adoption of the majority of the recommendations at the earliest possible date.*

Recommendation 10.2 That priority attention be given to Recommendations 1, 2, 3, 9, 14, 18, 19, 23, 24, 25, 26, 27, 31, and 32 of the Major Projects Task Force.

10.3.1 The Major Projects Assessment Agency

MPTF Recommendation 1 The provision of accurate, complete, and timely information on major projects was seen as valuable to governments at all levels, owners, contractors, labour, suppliers of equipment and materials, financiers, and other parties connected with the industry. The development of an agency to gather and disseminate these data is an important factor in providing an information base necessary to the restarting of major project activities. However, it will be necessary for this agency to be one that could be trusted with data from a variety of sources and would be highly sensitive to such concerns as confidentiality. The nature and makeup of the agency is therefore seen as significant in determining its success, and the study group urges that this concern be given serious consideration. We would add to the recommendation the further suggestion that the CIDC and other interested parties be consulted in the agency's development and about its composition.

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MAJOR CANADIAN PROJECTS MAJOR CANADIAN OPPORTUNITIES

A REPORT BY THE CONSULTATIVE TASK FORCE ON INDUSTRIAL AND REGIONAL BENEFITS FROM MAJOR CANADIAN PROJECTS

JUNE 1981

This report has been prepared by the Consultative Task Force on Industrial and Regional Benefits from Major Canadian Projects, generally referred to as the Major Projects Task Force, and represents the culmination of over two years of effort by this bipartite business-labour body. Although established under the auspices of the federal Minister of Industry, Trade and Commerce after discussions with the provincial ministers of industry, the Task Force has carried out its work independently.

The report discusses the nature and extent of the potential Canadian industrial and regional benefits which could arise from major capital projects to be constructed in this country to the end of the century. Recommendations have been included which the Task Force believes will help to maximize the flow of these benefits to Canadians.

1. **Recommendation: A Major Projects Assessment Agency, as described in Chapter 7, should be established with objectives and responsibilities which include information gathering, aggregation and dissemination.**

10.3.2 Canadian Participation in Major Projects

MPTF Recommendation 2 The study group expressed very strong support for the recommendation, based on a generally agreed perception that the use of Canadian talent on major projects had not received adequate support in the past. If the nation is to control its own development, it must support the opportunity for the human resources of the nation, in all areas and levels, to be used to maximum effectiveness. To make this recommendation practicable, it will be necessary to develop a realistic assessment of skills required in projects. Should Canadians not be able to fill positions, artificial barriers damaging to the ability of projects to proceed should not be created, but all reasonable efforts should be devoted to training and development opportunities that will enhance potential.

MPTF Recommendation 3 The continuing development of Canadian-owned and Canadian-based firms and their selection for important roles in major projects were supported strongly by the study group. In the study group, there was substantial respect for the contributions made by non-Canadian organizations and much less concern about their negative effect than pervades the report of the task force. It was agreed, however, that it would be greatly in the interest of the nation, its people, and its enterprise to create a climate in which Canadian participation, ownership, and control were encouraged to the highest degree possible.

As an important corollary to both MPTF Recommendations 2 and 3, the study group felt that the provinces and territories should be encouraged to participate in this approach. The industry has noted an increasing tendency towards regionalization that is not in the interest of the nation and would like to see a national approach adopted.

10.3.3 Reviews of the Regulatory Process

MPTF Recommendation 9 Regulatory concerns have increasingly become a major consideration in large capital projects, especially because there is substantial duplication and uncertainty in this field. Although people may argue the degree or nature of regulation required, there is no disagreement that it is the responsibility of government to establish the regulations under which work will be done. However, the industry would be better able to conduct its business if the various jurisdictions could rationalize regulations and regulatory processes in such a way that duplication, conflict, and delay were reduced. The stance taken in some areas by the federal government of using moral suasion rather than rules has been effective and flexible; but the position frustrates contractors and often has the appearance of being arbitrary. This issue deserves the greatest possible concentrated attention and the accelerated cooperative effort of the provincial and federal governments.

10.3.4 Certification and Licensing Requirements

MPTF Recommendation 14 Improvement in the standardization of certification and licensing for manpower across the nation was strongly supported by the study group. It was felt that such standardization would facilitate an increase in the employability of Canadian manpower, improve mobility, and promote increased productivity. At the same time, both government and business would be able to do more effective manpower planning. To accomplish this standardization, a substantial degree of cooperation among provinces would be required.

10.3.5 The Mobility of Manpower

MPTF Recommendations 18 and 19 Major projects in Canada require a high degree of worker mobility. Especially during construction, such projects generally demand a larger number of workers than the immediate region can supply or maintain following project completion. Any barriers to mobility,

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2. **Recommendation: Every reasonable effort should be made to ensure that Canadians have access to all managerial, professional, technical, skilled trades and general labour positions relevant to the planning, engineering, construction and eventual operation of major projects.**

MPTF Recommendation 3 The continuing development of Canadian owned and Canadian based firms and their selection for important roles in major projects were supported strongly by the study group. In the study group, there was substantial respect for the contributions made by non Canadian organizations and much less concern about their negative effect than pervades the report of the task force. It was agreed, however, that it would be greatly in the interest of the nation, its people, and its enterprise to create a climate in which Canadian participation, ownership, and control were encouraged to the highest degree possible.

3. **Recommendation: Recognizing that potential participants in major projects have to be assessed on a firm-by-firm basis in order to determine the contribution they will make to the maximization of Canadian industrial and regional benefits, Canadian-owned firms or, as a second priority, other Canadian-based firms, should be selected to play key actor roles (including owner/sponsors, MEPC firms, and suppliers and sub-suppliers of goods and services) in future major Canadian projects.**

In cases where no Canadian-owned or other Canadian-based firm is deemed to be capable of undertaking the work associated with a particular key actor role in a major project, work should be packaged in ways that allow participation by these types of firms in accordance with the contribution they will make to the maximization of Canadian industrial and regional benefits.

As an important corollary to both MPTF Recommendations 2 and 3, the study group felt that the provinces and territories should be encouraged to participate in this approach. The industry has noted an increasing tendency towards regionalization that is not in the interest of the nation and would like to see a national approach adopted.

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9. **Recommendation: Governments at both levels should undertake extensive reviews of the regulatory process in order to eliminate duplication and avoid unnecessary delays in the progress of major projects.**

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14. **Recommendation: Provincial certification programs and licensing requirements should be more fully standardized and coordinated on a national basis through consultation among the provinces. Business and labour organizations should continue to facilitate any initiatives taken in this regard.**

10.3.5 The Mobility of Manpower

MPTF Recommendations 18 and 19 Major projects in Canada require a high degree of worker mobility. Especially during construction, such projects generally demand a larger number of workers than the immediate region can supply or maintain following project completion. Any barriers to mobility,

18. **Recommendation: Barriers to the mobility of labour resulting from varying apprenticeship standards and inadequate pension vesting provisions should be eliminated wherever possible. The elimination of interprovincial barriers to mobility based on arbitrary local preferences** is also strongly recommended in cases where such preferences do not provide long-term benefits to Canadians.

whether they be inconsistent certification standards, preferential hiring requirements, or a variety of others, reduce the rate of employment of Canadian workers and tend to increase the demand for allowing entry of foreign workers. The need for cooperative efforts to reduce barriers and increase incentives to internal mobility of manpower is strongly supported.

10.3.6 Technology

MPTF Recommendations 23, 24, 25, and 26 Canada needs to seize every opportunity available for the development of technology appropriate to the needs of the nation and its competitive position in the world. This matter is important not only to increase the participation of Canadians in major projects but also to maintain and improve Canada's position in the world — especially the ability to compete in the export of services and technology. Strong support for these recommendations was modified by some concerns (see section 10.4.4).

10.3.7 Procurement Policies

MPTF Recommendation 27 Both the philosophy and practice of procurement policies in major projects should be clearly defined and expressed. The definition of Canadian content should be expanded to become a broad concept of benefit to the nation, rather than a single, simplistic issue that may restrict opportunities to benefit the nation. There is a clear need for a sense of balance. The national interest must be seen clearly to be met in that balance, but any small-scale situation could permit alternatives (an example would be the concept of offsets).

10.3.8 Canadian Standards

MPTF Recommendations 31 and 32
The study group strongly commends the use of Canadian standards. Information about these standards and of Canadian capabilities should be widely disseminated to all non-Canadian entities involved in major projects in Canada. Many countries use their national standards to benefit their national interests on projects both at home and abroad. Canada should be doing the same. The establishment of additional Canadian design standards should become a major goal for both industry and government.

Such an effort would enhance the thrust of Recommendation 32, giving to Canadian firms an improved competitive opportunity to provide goods and services to major projects, both in Canada and in the global marketplace. (Concern about the establishment of unduly high standards is expressed in section 10.4.7.)

10.4 MPTF Recommendations Warranting Revision

During its consideration of the report, the study group found several issues with which it was in disagreement or where the members considered that substantial revision of the recommendations of the report was required. These issues, together with the associated recommendations and the reasons for disagreement or suggested revisions, are listed below.

10.4.1 Regional Equity

MPTF Recommendations 6, 7, and 8
The study group did not feel that it could support regional equity as a specific goal for major projects. Recommendations 6 and 7 were couched in very soft language, and the study group was in favour of the sentence in Recommendation 8 that urges removal of arbitrary barriers to the flow of manpower, goods, and services.

The artificial creation of an environment that, for purposes of regional equity, supports the establishment of non-competitive industry has not been successful in the past and is not likely to be in the future. However, the study group was basically sympathetic to the need of disadvantaged regions to improve the

whether they be inconsistent certification standards, preferential hiring requirements, or a variety of others, reduce the rate of employment of Canadian workers and tend to increase the demand for allowing entry of foreign workers. The need for cooperative efforts to reduce barriers and increase incentives to internal mobility of manpower is strongly supported.

19. **Recommendation: Financial assistance available for worker mobility should be improved and expanded. In this regard, major project owner/sponsors and MEPC firms should provide financial assistance for the relocation of workers from other regions to major project sites. Government programs such as the Canada Manpower Mobility Program should also be improved and expanded.**

10.3.6 Technology

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23. **Recommendation: Increased initiatives are required on the parts of governments and industry to develop in Canada the technology required for major Canadian projects. In this regard, governments should consider selective research and development contracts and other incentives designed to prepare Canadian suppliers for identified major project opportunities. For example, consideration should be given to establishing a product development fund to finance prototypes and encourage the creation of new world-competitive products and services.**

24. **Recommendation: The Government of Canada should maintain effective surveillance of imports of capital equipment to ensure that violations of the GATT and the Multilateral Trade Negotiations codes with respect to dumping, subsidies and other prohibited practices do not occur:**
(a) by constituting a Capital Goods Task Force with Revenue Canada with the specialized skills necessary to evaluate such imports; and
(b) by including within the proposed new Special Import Measures Act specific provisions directed against dumping and subsidization of capital equipment.

25. **Recommendation: Technology developed in Canada on major Canadian projects should be beneficially owned and controlled by Canadians. Where technology is purchased from outside the country, it should be acquired so as to ensure its ultimate beneficial ownership and control by Canadians wherever possible.**

26. **Recommendation: In cases where technological changes have the potential to significantly alter the terms and conditions of employment, the disruptive impact of such changes on labour should be mitigated through negotiation with employee representatives.**

10.3.7 Procurement Policies

MPTF Recommendation 27 Both the philosophy and practice of procurement policies in major projects should be clearly defined and expressed. The definition of Canadian content should be expanded to become a broad concept of benefit to the nation, rather than a single, simplistic issue that may restrict opportunities to benefit the nation. There is a clear need for a sense of balance. The national interest must be seen clearly to be met in that balance, but any small-scale situation could permit alternatives (an example would be the concept of offsets).

27. **Recommendation: In consultation with appropriate governments, major project owner/sponsors and MEPC contractors, both in the public and private sectors, should establish written procurement policies and undertake programs that will contribute to the objective of maximizing Canadian industrial and regional benefits. The contents of and adherence to such policies and programs should be reviewed by the Major Projects Assessment Agency described in Chapter 7.**

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MPTF Recommendations 31 and 32
The study group strongly commends the use of Canadian standards. Information about these standards and of Canadian capabilities should be widely disseminated to all non-Canadian entities involved in major projects in Canada. Many countries use their national standards to benefit their national interests on projects both at home and abroad. Canada should be doing the same. The establishment of additional Canadian design standards should become a major goal for both industry and government.

Such an effort would enhance the thrust of Recommendation 32, giving to Canadian firms an improved competitive opportunity to provide goods and services to major projects, both in Canada and in the global marketplace. (Concern about the establishment of unduly high standards is expressed in section 10.4.7.)

31. **Recommendation: In both the public and private sectors, project owner/sponsors and MEPC firms should, so far as possible, utilize design standards which provide the maximum opportunity for Canadian suppliers to compete effectively.**

32. **Recommendation: Major project participants, both in the public and private sectors, should make every effort to facilitate the participation of Canadian-owned suppliers of goods and services (including project management, engineering, procurement and construction services) in major projects. Where no Canadian-owned firm is capable of undertaking all of the work associated with a particular aspect of a major project, work should be packaged in terms of size, scope and timing in a way that allows the maximum participation by Canadian-owned firms and, as a second priority, by other Canadian-based firms. Major project participants should encourage the participation of these firms in a manner that provides them with the experience base necessary to meet more extensive portions of major project demands in the future.**

10.4 MPTF Recommendations Warranting Revision

During its consideration of the report, the study group found several issues with which it was in disagreement or where the members considered that substantial revision of the recommendations of the report was required. These issues, together with the associated recommendations and the reasons for disagreement or suggested revisions, are listed below.

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The artificial creation of an environment that, for purposes of regional equity, supports the establishment of non-competitive industry has not been successful in the past and is not likely to be in the future. However, the study group was basically sympathetic to the need of disadvantaged regions to improve the

6. **Recommendation: Where locational choices are not limited to a particular site, major projects and/or their associated support industries should be encouraged, as a matter of public policy, to locate in less advantaged regions.**

7. **Recommendation: Special efforts should be made to source labour, goods and services for major projects wherever feasible from less advantaged regions of the country.**

8. **Recommendation: Federal and provincial governments should jointly establish criteria for judging cases where regional sourcing preferences, relative to manpower, goods and services, are likely to be supportive of broader regional equity objectives in a long-term sense. In all other cases, arbitrary barriers to the flow of manpower, goods and services should be eliminated.**

quality of life and did not question the need of those regions to seek appropriate investment and encourage its location in the region.

But the location of major projects and the sourcing of goods, services, and manpower are complex business decisions requiring a vast amount of information. The study group did not believe that these decisions would appropriately be subject to regional equity pressures and was especially concerned about the implications of a recommendation that urged governments to establish criteria for judging the merits of business decisions. The establishment of a good source for accurate information about project requirements for goods and services would allow regional participation in the provision of supply and services instead of requiring relocation of projects for less than sound reasons.

10.4.2 Timing

MPFT Recommendation 11 The timing of major projects has important implications, both positive and negative, for regional and national economies, and the study group recognized this concern. The intrusions of government, however, into this area have potentially detrimental effects on competitive business planning. The study group suggested two ideas that would, to a limited degree, help minimize potential timing problems. First, serious consideration should be given to programs to promote training during periods of low demand. Second, a preplanned approach to public sector projects that would encourage their acceleration during periods of lowered demands by the private sector — that is, countercyclical public spending — should be undertaken.

10.4.3 Employment and Manpower

MPTF Recommendation 12 The study group concluded that the portion of Recommendation 12 referring to the institution of a levy or grant system to fund training in areas where there is a manpower deficiency is not appropriate to the construction industry.

MPTF Recommendation 20 Similarly, whereas the study group strongly endorsed the concept of following good labour practices, it was of the opinion that the portion of Recommendation 20 advocating the mandatory check-off of union dues was highly controversial. Likewise, project agreements, however short or limited in scope, arouse strong opposition in some segments of the construction industry and could not be given broad support at this time.

10.4.4 Technology

As stated in section 10.3.6, the study group strongly supports the development of Canadian technology and its beneficial ownership and control by Canadians. However, the study group recommends a more global view than appears to be contained in the report of the Major Projects Task Force. The development of Canadian technology must be encouraged with an awareness of Canadian needs and what is appropriate to the nation and in the context of Canada's participation in a global economy. There are some technologies whose use might appear to make sense from a strictly Canadian perspective, but that would be inappropriate in this broader view. The technology that makes sense for Canada in this larger view should be accelerated as much as possible. The value of external technology and its contribution to the nation can then be taken into account and used as appropriate.

Recommendation 10.3 That the pursuit of Canadian content goals not create barriers to the use of external technology in cases where such use is in the overall national interest.

10.4.5 Foreign Trade

Many of the recommendations of the task force's report, by strongly supporting a "Canada First" approach, have substantial implications for foreign trade. The study group supports the development of national interests, especially Canadian ownership and control of Canadian enterprise, but concluded that the task force's recommendations were excessive and potentially not in the nation's interests.

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11. Recommendation: Business, labour and government should cooperate to solve potential problem areas, including those related to the unacceptable peaking of major project demands, identified through the activities of the Major Projects Assessment Agency described in Chapter 7. The labour members of the Task Force believe that government, at both levels, should also use regulatory and legislative powers to ensure as far as possible that the demands of major projects are timed to attain optimum levels of Canadian benefits in terms of stable employment and efficient utilization of Canadian industrial capacity.

10.4.3 Employment and Manpower

MPTF Recommendation 12 The study group concluded that the portion of Recommendation 12 referring to the institution of a levy or grant system to fund training in areas where there is a manpower deficiency is not appropriate to the construction industry.

12. Recommendation: There should be a shift in emphasis in training programs towards increased on-the-job training. This should involve a reallocation of spending priorities for government training programs such as the Canada Manpower Training Program. Action will also be required to ensure the expansion of on-the-job training by industry. It is proposed that a levy/grant system be introduced on an experimental and selective, sectoral basis to impose a payroll training tax levy on employers in those industries where training-related shortages are known to exist. The funds would be distributed to those employers who actually institute approved training programs.

MPTF Recommendation 20 Similarly, whereas the study group strongly endorsed the concept of following good labour practices, it was of the opinion that the portion of Recommendation 20 advocating the mandatory check-off of union dues was highly controversial. Likewise, project agreements, however short or limited in scope, arouse strong opposition in some segments of the construction industry and could not be given broad support at this time.

20. Recommendation: Major project owner/sponsors and MEPC firms should follow good labour practices, including recognizing both the spirit and the letter of workers' legal right to organize, without interference by employers, and bargain collectively. In order to ensure the continuing viability of the bargaining unit, governments in all jurisdictions should implement the practice of mandatory dues check-off.

10.4.4 Technology

As stated in section 10.3.6, the study group strongly supports the development of Canadian technology and its beneficial ownership and control by Canadians. However, the study group recommends a more global view than appears to be contained in the report of the Major Projects Task Force. The development of Canadian technology must be encouraged with an awareness of Canadian needs and what is appropriate to the nation and in the context of Canada's participation in a global economy. There are some technologies whose use might appear to make sense from a strictly Canadian perspective, but that would be inappropriate in this broader view. The technology that makes sense for Canada in this larger view should be accelerated as much as possible. The value of external technology and its contribution to the nation can then be taken into account and used as appropriate.

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Recommendation 10.4 That the Canadian government be a flexible, proactive supporter in its ongoing efforts to create a policy environment that would encourage Canadian industry to compete successfully in foreign markets against the government-supported programs of foreign nations.

10.4.6 Preferential Premiums

MPTF Recommendation 29 The preference policy contained in the two versions of the task force's Recommendation 29 was supported in principle but could not be supported as stated. The study group was concerned about labour's advocacy of forced compliance and the mechanisms of bureaucratic enforcement that would be required to make owners comply. The business recommendation, on the other hand, could present the problem of getting owners to comply at all. In addition, the recommendation would create strong pressure to increase project costs by 3 per cent, thus increasing the problems already involved in the financing of major projects. This issue has great potential for controversy and requires substantial consideration, discussion, and debate by interested parties before the benefits and potential pitfalls can be clarified.

Recommendation 10.5 That provisions for the payment of a premium for Canadian goods and services supplied to major projects as a general requirement be discussed by interested parties with a view to increasing Canada's long-term industrial strength; and that in the meantime, the payment of preferential premiums should be negotiated on a project-by-project basis.

10.4.7 Standards: Implications for Exports

As stated in section 10.3.8, the study group strongly favours the specified use of Canadian standards. It is a source of pride that in many areas Canada has design standards that are among the highest in the world. Their application to foreign work, however, may not be appropriate, and the imposition of standards whose focus is technical excellence may reduce Canadian competitiveness. Similarly, unduly high

design standards on Canadian industrial projects can increase the cost of products to the point that they are difficult to sell abroad. A realistic reassessment of standards in the context of world markets is needed.

Recommendation 10.8 That the Government of Canada undertake an extensive review of the process of developing Canadian standards and of current Canadian standards from the standpoint of assuring their competitiveness in world markets.

10.4.8 World Product Mandates

MPTF Recommendation 38 The study group questions the designation of a world product mandate as a desirable approach for the Canadian operations of foreign-owned manufacturers. Rather, the Science Council of Canada's observations, as contained in its publication *Hard Times, Hard Choices*, are supported. These views may be paraphrased as follows.

First, in that the Canadian plant has by definition a particular mandate, world product mandating removes incentives for the development of new products to meet changing needs.

Second, the tendency to mandate to smaller, less automated Canadian plants of lower volume or of products on the decline in the market causes the Canadian operation to become increasingly obsolete.

Third, leading-edge technology products and high research and development activity is likely to be reserved for the foreign parent facilities where responsibility for overall market survival lies.

10.4.9 Marketing Excess In-house Capacity

MPTF Recommendation 39 The marketing of excess in-house capacity by major project owners or sponsors is not recommended. Such action has a highly disruptive effect on the established MEPC sector of the industry and would reduce its long-term effective development. The marketing of owner's or sponsor's project management resources should be encouraged only in instances where special skills, expert knowledge, or capacity complementary to those of the MEPC sector exist and where there is a cooperative approach to seeking export markets.

Recommendation 10.4 That the Canadian government be a flexible, proactive supporter in its ongoing efforts to create a policy environment that would encourage Canadian industry to compete successfully in foreign markets against the government supported programs of foreign nations.

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29. Business Recommendation: Major project participants, both in the public and private sectors, *should be encouraged to pay* premiums totalling up to a maximum of 3 per cent of total project cost for the development of and purchases from generally competitive Canadian-based suppliers. Premiums should be allotted among Canadian-based firms in cases where it will contribute to the creation of new long-term industrial capability in Canada that can operate on a generally competitive basis. A discussion of some of the long-term benefits to Canada from the payment of such premiums is contained in Appendix D.

Labour Recommendation: Major project participants, both in the public and private sectors, *should pay* premiums totalling up to a maximum of 3 per cent of total project cost for the development of and purchases from generally competitive Canadian-based suppliers. Premiums should be allotted among Canadian-based firms in cases where it will contribute to the creation of new long-term industrial capability in Canada that can operate on a generally competitive basis. A discussion of some of the long-term benefits to Canada from the payment of such premiums is contained in Appendix D.

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Third, leading-edge technology products and high research and development activity is likely to be reserved for the foreign parent facilities where responsibility for overall market survival lies.

38. Recommendation: Governments should ensure that the Canadian operations of foreign-owned multinational enterprises are assigned the corporate responsibility of pursuing export trade opportunities. One approach to this is the designation of world product mandates for types of goods developed and manufactured in Canada.

10.4.9 Marketing Excess In-house Capacity

MPTF Recommendation 39 The marketing of excess in-house capacity by major project owners or sponsors is not recommended. Such action has a highly disruptive effect on the established MEPC sector of the industry and would reduce its long-term effective development. The marketing of owner's or sponsor's project management resources should be encouraged only in instances where special skills, expert knowledge, or capacity complementary to those of the MEPC sector exist and where there is a cooperative approach to seeking export markets.

39. Recommendation: Major project owner/sponsors who develop substantial in-house expertise should market any excess capability.

10.5 Areas of Concern

The study group identified six areas of concern arising from the consideration of the MPTF report. The areas were not related to specific recommendations but were considered sufficiently important to merit inclusion in this appraisal.

10.5.1 Productivity

A great deal of concern has been expressed about low levels of productivity in Canadian industry. Although much concern has taken the form of casting blame, there is particular reason for concern about productivity in major project realization. This is a matter that should not be approached in a simplistic manner but should be subjected to serious research. In the view of the study group, the areas in which the most gains in productivity could probably be achieved would be improvements in management; the regulatory environment; the use of technology; appropriateness, effectiveness, and quality of training; legislation; and worker effectiveness. Improvement of productivity is a major potential source of benefit to the nation and to its competitive position in the world. (This issue is considered extensively in chapter six).

Recommendation 10.7 That governments and owners encourage and support initiatives by the construction industry and research organizations devoted to research programs on ways and means of removing or reducing factors that impair productivity in the realization of major projects.

10.5.2 The Benefits of Major Projects

There is wide agreement that major projects can be a substantial force for the economic well-being of the nation and an important element in deriving a recovery from the lean times currently being experienced. Many of these benefits are highly visible. However, the unqualified acceptance of this assumption and the potential for possible negative effects of major projects have been subjected to relatively little examination. For example, magnitude is frequently a source of proportionate pride attached to a venture and may tend to affect the appropriateness of scale. The present breathing spell can be used by owners or sponsors to plan in greater detail, including the minimizing of any potentially serious adverse effects of a major project on a region.

Recommendation 10.8 That careful consideration be given to an examination of (a) the real benefits of major projects and how such benefits can be optimized and (b) the possible negative consequences of major projects and how the regions affected and the nation as a whole could best minimize damages.

10.5.3 Canadianization

The entire concept of "Canadianization" — that is, increased Canadian ownership, control, and participation — is highly subject to oversimplification, both by its supporters and by its opponents. The study group supports the principle of "Canadianization" but is concerned that very little publicity has been given to the important issues involved, resulting in a lack of adequate information and a consequent polarization of views. Many of the alleged negative effects are unlikely to stand up to objective investigation.

Recommendation 10.9 That in the interests of the nation, the Government of Canada sponsor a highly pragmatic study of Canadianization to provide factual cost/benefit data to be incorporated in an appropriate strategy that encourages development and recognizes Canada's position as a member of the world economy.

10.5.4 Regionalization

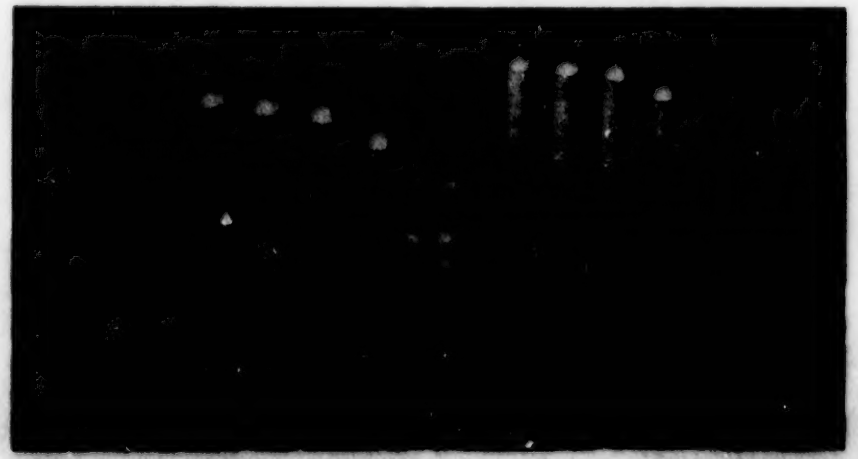
The desire to distribute the benefits from major projects across the various regions of the country is understandable. However, any extreme or artificial applications of this policy resulting in uneconomic plant locations or project costs should be avoided, for such applications reduce the viability of major projects. Efforts to improve intergovernmental and interregional cooperation on such matters must be given urgent and serious consideration.

10.5.5 Changes in the Industry

The business engaged in the realization of major capital projects is in the early stages of what is likely to be a series of major changes. In response to such factors as economic pressures, changes in technology and human value, political environment and a host of others, the industry, and particularly its MEPC sector, is likely to be radically different in the future. The importance of these changes and their likely effect cannot be overstated. The present composition of the MEPC sector, let alone its likely future make-up, is not well documented; both aspects should be studied.

10.5.6 Economic Effects

A major potential opportunity and benefit to Canada recognized in the MPTF report is the development of a significant MEPC capability and associated high technology, through the execution of major projects by Canadian companies. During the period before 1982, significant growth took place in person-



nel quality and expertise and in overall industry capability, encouraged by the potential Canadian market and the opportunity for significant export of services. This growth was strongly encouraged by government.

The 1982 recessionary period and its continuation in 1983 have severely damaged this development. By mid-1985, the personnel employed in the Canadian MEPC service industry is likely to be reduced to less than 30 per cent of 1981 levels. Many questions have been raised: the nature and timing of recovery, options available for retaining the remaining skills, where the lost personnel have gone, and whether they are recoverable. There is no question that the industry as a whole has been hit very hard, but there is not a clear understanding of the implications. This, taken with the effect of change mentioned above, has placed the MEPC sector in a position of uncertainty.

Recommendation 10.10 That in view of the importance placed on the development of the manage-engineer-procure-construct sector of the industry and the sector's contribution to the health and growth of the industrial manufacturing sector, to Canadian exports, and to the development of technology in Canada, the government fund, in conjunction with industry, a comprehensive research program into all aspects of capital projects realization with special emphasis on the MEPC sector.

It would be of particular benefit if the services of the MEPC sector itself were used in such a study. The study should consider all aspects of project realization, using both historical data from completed projects and modelling of proposed work, to provide usable and appropriately documented data. This could then be used both by the government and the industry to make significant policy decisions. A number of the issues such a research program might consider are listed in Annex A.

Annex A

Research Topics Related to the Execution of Major Projects

The following is an abbreviated listing of some of the elements related to the realization of major projects in Canada that are in need of further research.

1. Collection of data on the make-up of the MEPC industry and its growth during the past decade and a detailed analysis of the change in capacity (personnel, management skills, technology, etc.) during 1982-83.
2. An evaluation of the industry's potential capacity to expand quickly or respond to various levels of need and the constraint this may place on the rate of project development.
3. The beneficial economic spinoffs of major projects in terms of
   - technology leadership
   - specialized industry growth
   - improvements of techniques
   - export opportunities
   - product development
   - mobility
   - closing of regional gaps.
4. The volume effects of major projects:
   - for example, one project, several or many, within a single region, remote or urban
   - capacity of Canadian industry - limits of resources, if any.
5. A risk analysis of undertaking major projects:
   - compounding vs. sharing (consortium)
   - bankers' role in equity
   - government role in equity and debt
   - technologists' role
   - market's role
   - effect of long lead time on level of risk
   - availability of money
   - Canadian savings vs. imported capital
   - inflation
   - productivity's influence on unit construction costs
   - management capability
   - relative prices, construction cost vs. product price
   - government rules, variations, and threat of retroactivity
   - rate of return.
6. Role of the resource owner:
   - federal vs. provincial requirements
   - economic rents
   - standards for safety, environment, etc.
   - value of Canadian content
   - COGO or POGO* (the U.S. models) vs. crown corporations
   - government's stake in profits, losses, or as an element of cost
   - tax regimes on capital.
7. The effects of time:
   - the cost of time, accountability and payment for delays
   - shrinkage of time frame
   - future Canadian position with or without major project activity
   - labour-capital ratios on future mega projects.

* Company/Privately Operated, Government Owned.

Annex B

Findings and Recommendations of the Major Projects Task Force

INFORMATION AND PLANNING

Availability and Use of Information

In the most fundamental terms, planning for any economic activity depends upon the timely availability and effective use of pertinent information. This is particularly relevant in the broad context of seeking to maximize Canadian industrial and regional benefits arising from major projects.

Industrial expansion and the associated development of employment opportunities are highly dependent on the early recognition and exploitation of opportunities. There is a clear need for comprehensive information in an aggregated form concerning the requirements that major projects will generate for manpower, goods, services and financing, and the ability of the Canadian economy to meet those needs. In turn, this information can be used to increase the opportunities for Canadian entities to evolve their capabilities, through the development of special programs, plants and other facilities in areas where there is significant potential to increase the level of Canadian participation.

Throughout its work, the Major Projects Task Force regularly encountered a lack of pertinent and up-to-date information regarding the detailed demands for and

supply of services, materials, equipment, financing and labour. This made the Task Force's work difficult but, more important, it highlighted difficulties experienced by suppliers, financial institutions, educators, labour, governments and others as they attempt to assess such data on a regular basis and formulate plans based on it.

The Task Force found that although there may in many cases be substantial data prepared, there is frequently a reluctance to make it publicly available. This situation generally arises from concerns about being held accountable for the accuracy of what may be very preliminary information, or due to a belief by the participant that disclosure may compromise the firm's competitive position. In order to help allay these concerns to some degree, it will be necessary, in any information collection exercise, for there to be a clear statement of: the content and level of detail of information required; specification of what the information will be used for, how it will be aggregated and to whom it will be provided; and provision for the supplier of the information to indicate its status (i.e., preliminary, final, estimated, actual, etc.).

In other cases, the Task Force found that project participants do not have particularly extensive, detailed, up-to-date or accurate project-related demand and supply information. This situation may be explained at least in part by the fact that such information has not been considered so important in the past. Since the various demands in question have previously been adequately met from within Canada due to lower levels of demand or, alternatively, because of imports of goods, services, financing and manpower have traditionally been available to supplement Canadian supply sources, the capability of the Canadian supply community has not necessarily been considered a critical factor in project planning and therefore detailed demand and supply information has not been developed.

Finally, the Task Force found that data prepared by project participants are often incompatible or inconsistent. At times, this occurs within a particular project, but it is more often the case between various projects. Classifications, methodologies, areas assessed and assumptions used vary widely. Such variations make meaningful aggregations difficult to carry out, and such aggregations as are completed may be misleading.

In the past, such information deficiencies were not as significant as they are certain to be in the future. This conclusion is based in part on the following three factors:

(a) Future demands for goods, services, financing and labour on major Canadian projects will reach unprecedented levels, both on individual projects and in aggregate.

(b) Major project activity in other parts of the world will be substantial and will attract goods, services, financing and perhaps manpower which in the past might have been available for use in Canada.

(c) Canada's economy is currently characterized by high unemployment and underutilized industrial capacity.

These factors, among others, will make the past and present lack of information unacceptable in the future, as any plans to expand capabilities must be based on a knowledge of what the demands for those capabilities are likely to be. Generating the various kinds of relevant data is only the first step. For information to be meaningful and effectively used, it must be aggregated at an appropriate level or levels and made available to those who require it for planning purposes. Only through this process can potential opportunities and problems be identified and action taken.

Recognizing therefore the importance of continuously upgraded information and planning to the objective of maximizing Canadian industrial and regional benefits from major projects, the Major Projects Task Force makes the following recommendation:

1. Recommendation: A Major Projects Assessment Agency, as described in Chapter 7, should be established with objectives and responsibilities which include information gathering, aggregation and dissemination.

POLICY ENVIRONMENT

The recommendations in this section concern themselves with the policy environment required for the maximization of industrial and regional benefits from major projects. A common theme of many of these recommendations is the need for positive action on the parts of the federal and provincial governments.

Recommendations grouped under this heading deal with:
- Canadian participation, ownership and control;
- regional equity;
- government legislation and administrative practice;
- timing of major projects.

Canadian Participation, Ownership and Control

The maximization of the level of participation by Canadians in all phases of major project activity in Canada is an issue of prime importance. Any such maximization necessarily implies the development of Canadian manpower, technological, industrial and financial resources within an environment that will promote their optimum use. In this connection, the Task Force has found that in some cases the participation of foreign-owned MNEs in key actor roles in major projects may be more likely to give rise to a shortfall in benefits than would be the case if a Canadian-owned firm had played the same role.

The question of ownership of the projects themselves and of their participants is also of concern with respect to the long-term outflow of dividend payments and the resulting effect on Canada's international balance of payments position.

With the above objectives and concerns in mind, the Task Force makes the following recommendations:

2. Recommendation: Every reasonable effort should be made to ensure that Canadians have access to all managerial, professional, technical, skilled trades and general labour positions relevant to the planning, engineering, construction and eventual operation of major projects.

3. Recommendation: Recognizing that potential participants in major projects have to be assessed on a firm-by-firm basis in order to determine the contribution they will make to

the maximization of Canadian industrial and regional benefits, Canadian-owned firms or, as a second priority, other Canadian-based firms, should be selected to play key actor roles (including owner/sponsors, MEPC firms, and suppliers and subsuppliers of goods and services) in future major Canadian projects.

In cases where no Canadian-owned or other Canadian-based firm is deemed to be capable of undertaking the work associated with a particular key actor role in a major project, work should be packaged in ways that allow participation by these types of firms in accordance with the contribution they will make to the maximization of Canadian industrial and regional benefits.

4. Recommendation: Project financiers should not, when offering financial terms, discriminate against projects with a high degree of participation by Canadian-owned firms in key actor roles.

5. Recommendation: With respect to improving Canada's balance of payments position, major project participants (including owner/sponsors, MEPC firms, and suppliers and subsuppliers of goods and services) should afford Canadians the maximum opportunity to participate in the equity ownership of the projects themselves and of their firms.

Regional Equity

Canada has been built on the concept of sharing and cooperation. Through the course of the country's history, the advantaged regions of Canada have aided the less advantaged ones. Major project development in Canada must provide all regions with the opportunity to participate directly so much as possible, but also to share the advantages of the wealth which will flow indirectly from the projects.

The fostering of greater equity among Canada's regions has been a longstanding goal of Canadian federal and provincial governments, and certain actions have been taken which have been felt to contribute to the attainment of this goal. In particular, some provincial governments have established provincial and/or regional sourcing requirements with respect to manpower, goods and services. While recognizing that benefits sometimes accrue from regional sourcing preferences, it is the belief of the Major Projects Task Force that progress towards regional equity is not enhanced in the long term by the erection of arbitrary barriers to the flow of manpower, goods and services within the country.

With the objective of increasing long-term regional equity within Canada, the Task Force makes the following recommendations:

6. Recommendation: Where locational choices are not limited to a particular site, major projects and/or their associated support industries should be encouraged, as a matter of public policy, to locate in less advantaged regions.

7. Recommendation: Special efforts should be made to source labour, goods and services for major projects wherever feasible from less advantaged regions of the country.

8. Recommendation: Federal and provincial governments should jointly establish criteria for judging cases where regional sourcing preferences, relative to manpower, goods and services, are likely to be supportive of broader regional equity objectives in a long-term sense. In all other cases, arbitrary barriers to the flow of manpower, goods and services should be eliminated.

Legislation and Administrative Practice

The Major Projects Task Force has found deficiencies and inconsistencies in the area of federal and provincial legislation and administrative practice which work against the maximization of Canadian industrial and regional benefits arising from major projects. The business members of the Task Force believe that such inconsistencies create a general atmosphere of uncertainty concerning the "rules of the game".

With the objective of improved government legislation and administrative practice, the Task Force makes the following recommendations:

9. Recommendation: Governments at both levels should undertake extensive reviews of the regulatory process in order to eliminate duplication and avoid unnecessary delays in the progress of major projects.

10. Recommendation: A clear set of guidelines with respect to expected behaviour in the area of Canadian industrial and regional benefits should be developed and applied to all key actors in major projects (including owner/sponsors, MEPC firms, suppliers of goods and services, financiers and labour unions, as applicable). These guidelines should extend to both the public and private sectors, as well as to both Canadian-owned and foreign-owned firms. Major project participants should develop written plans outlining how they intend to conform with these guidelines. The development of the guidelines and monitoring of the project participants' conformance with their plans should be the responsibility of the Major Projects Assessment Agency described in Chapter 7. The labour members of the Task Force believe that government should ensure conformance with these guidelines through the use of legislative, regulatory and financial powers.

Timing of Major Projects

There is a strong possibility that benefits could be lost because of the simultaneous peaking of demands for manpower, goods and services arising from several major projects proceeding at the same time. It follows that actions to smooth out the level of demands for inputs to major projects will result in the capture of additional benefits to Canada.

11. Recommendation: Business, labour and government should cooperate to solve potential problem areas, including those related to the unacceptable peaking of major project demands, identified through the activities of the Major Projects Assessment Agency described in Chapter 7. The labour members of the Task Force believe that government, at both levels, should also use regulatory and legislative powers to ensure as far as possible that the demands of major projects are timed to attain optimum levels of Canadian benefits in terms of stable employment and efficient utilization of Canadian industrial capacity.

ECONOMIC BASE

The final group of Task Force recommendations relates specifically to the strengthening of the manpower, technological, industrial and financial components of the economic base.

Employment and Manpower

Major project activity will provide, both directly and indirectly, expanded employment opportunities for Canadians. To a large extent, the major project labour requirements will be heavily weighted towards specialized skills. Special efforts will be required if the necessary skilled workers are to be provided in sufficient numbers from Canadian sources. Specific actions required include those dealing with the problems of inadequate planning, training and utilization of manpower, the relative immobility of labour between Canada's regions, and special labour relations considerations within the major project environment. The Major Projects Task Force has developed the following recommendations to deal with these problems related to the manpower base.

Training and Utilization of Manpower

An improved capability and commitment to train Canadians for the specific employment opportunities arising from major projects are essential if benefits to Canada are to be maximized. This will require a greater emphasis on the creation of on-the-job training facilities, a more standardized and coordinated trade certification process, and the more effective use of occupationally disadvantaged workers.

12. Recommendation: There should be a shift in emphasis in training programs towards increased on-the-job training. This should involve a reallocation of spending priorities for government training programs such as the Canada Manpower Training Program. Action will also be required to ensure the expansion of on-the-job training by industry. It is proposed that a levy/grant system be introduced on an experimental and selective, sectoral basis to impose a payroll training tax levy on employers in those industries where training-related shortages are known to exist. The funds would be distributed to those employers who actually institute approved training programs.

13. Recommendation: The attractiveness of trades careers and of non-traditional career patterns should be emphasized through a combined program of extensive advertising and career counselling in high schools.

14. Recommendation: Provincial certification programs and licensing requirements should be more fully standardized and coordinated on a national basis through consultation among the provinces. Business and labour organizations should continue to facilitate any initiatives taken in this regard.

15. Recommendation: Academic institutions, industry and organized labour must work together more closely to help ensure the relevancy of academic programs. Increased information flows will assist in any reviews undertaken in this regard.

16. Recommendation: Immigration should not be relied upon, other than in exceptional cases, to meet future Canadian manpower requirements. Government should issue temporary employment authorizations only when it has been clearly established that such authorizations will not displace qualified Canadians and only when specific commitments are made with respect to training a Canadian replacement for the foreign worker (succession plan). Furthermore, employment authorizations should only be issued to those individuals who will be working for firms which can demonstrate a history of, and make undertakings related to, effective manpower planning, support for a "Canadians first" policy, training, and support for affirmative action initiatives.

17. Recommendation: Special programs should be developed by government, business and labour to further the employment of the occupationally disadvantaged. Particular effort should be directed towards the employment of women, the disabled, natives and workers from high unemployment regions. The labour members of the Task Force believe that government should use its leverage via procurement, grants to industry, etc., to guarantee progress in this direction.

Labour Mobility

Barriers to the mobility of labour between regions limit the effective utilization of Canadian manpower resources. Mobility can be improved through a combined program of eliminating arbitrary barriers, increasing expenditures on relocation assistance, and improving the flow of information about job opportunities.

18. Recommendation: Barriers to the mobility of labour resulting from varying apprenticeship standards and inadequate pension vesting provisions should be eliminated wherever possible. The elimination of interprovincial barriers to mobility based on arbitrary local preferences is also strongly recommended in cases where such preferences do not provide long-term benefits to Canadians.

19. Recommendation: Financial assistance available for worker mobility should be improved and expanded. In this regard, major project owner/sponsors and MEPC firms should provide financial assistance for the relocation of workers from other regions to major project sites. Government programs such as the Canada Manpower Mobility Program should also be improved and expanded.

Labour Relations

Major projects provide opportunities for management and labour to cooperate in the creation of mutually advantageous industrial relations environments at the project level. The very nature of these projects is such that they should demonstrate leadership in labour practices.

Canada's industrial relations system has evolved to a level of relative sophistication and maturity. The right of workers to organize and engage in collective bargaining is a democratic principle reflected in the laws of Canada and echoed in long-established international labour standards to which Canada is a signatory. It is vital to the optimum realization of benefits from major projects that such rights be recognized by major project sponsors and their sub-contractors.

20. Recommendation: Major project owner/sponsors and MEPC firms should follow good labour practices, including recognizing both the spirit and the letter of workers' legal right to organize, without interference by employers, and bargain collectively. In order to ensure the continuing viability of the bargaining unit, governments in all jurisdictions should implement the practice of mandatory dues check-off.
21. Recommendation: Labour issues should be resolved by labour and management officials who are resident in Canada and who have the understanding and authority to bring industrial relations issues to final resolution.
22. Recommendation: Governments should enact legislation which permits the establishment of project agreements of limited duration in cases where employees have freely chosen their bargaining agents and where bargaining agents and employers have determined that such an agreement is appropriate.

Technology

Major projects being planned and constructed in Canada before the end of the century will have very large requirements for various kinds of technologies. Opportunities therefore now exist to support particular technological developments within this country based on these domestic market demands, while looking as well at export potential. Such Canadian technological developments will be necessary if Canada is to improve or even maintain its competitive position in the world. In this regard, technological research and development is a key contributor to the ability of Canadian firms to compete effectively as suppliers to major projects within Canada and in export markets, and the importance of R & D must be recognized. Although government support is important in this respect, project sponsors have the prime responsibility for stimulating Canadian R & D activity in relation to their individual requirements.

The Major Projects Task Force believes that efforts to increase the development of technology should receive high priority. At the same time, it is recognized that new technology must be implemented in an orderly fashion and that every effort should be made to minimize any adverse effects on labour.

23. Recommendation: Increased initiatives are required on the parts of governments and industry to develop in Canada the technology required for major Canadian projects. In this regard, governments should consider selective research and development contracts and other incentives designed to prepare Canadian suppliers for identified major project opportunities. For example, consideration should be given to establishing a product development fund to finance prototypes and encourage the creation of new world-competitive products and services.
24. Recommendation: The Government of Canada should maintain effective surveillance of imports of capital equipment to ensure that violations of the GATT and the Multilateral Trade Negotiations codes with respect to dumping, subsidies and other prohibited practices do not occur:
(a) by constituting a Capital Goods Task Force within Revenue Canada with the specialized skills necessary to evaluate such imports; and
(b) by including within the proposed new Special Import Measures Act specific provisions directed against dumping and subsidization of capital equipment.
25. Recommendation: Technology developed in Canada on major Canadian projects should be beneficially owned and controlled by Canadians. Where technology is purchased from outside the country, it should be acquired so as to ensure its ultimate beneficial ownership and control by Canadians wherever possible.
26. Recommendation: In cases where technological changes have the potential to significantly alter the terms and conditions of employment, the disruptive impact of such changes on labour should be mitigated through negotiation with employee representatives.

Industrial Base — Manufacturing and MEPC Capability

Significant development will be required in many of Canada's industrial sectors in order to meet the demands of major Canadian projects over the period to the year 2000. Manufactured inputs will be required, as will various services including project management, engineering, procurement and construction services. The following recommendations are put forward by the Major Projects Task Force to assist in the development of the required manufacturing and service capabilities in Canada.

Procurement Policies and Programs

The Task Force strongly believes that procurement policies and programs can be effectively used, both in the public and private sectors, to maximize Canadian industrial and regional benefits from major projects and to thereby increase Canadian industrial capability. In this regard, the Task Force makes the following recommendations:

27. Recommendation: In consultation with appropriate governments, major project owner/sponsors and MEPC contractors, both in the public and private sectors, should establish written procurement policies and undertake programs that will contribute to the objective of maximizing Canadian industrial and regional benefits. The contents of and adherence to such policies and programs should be reviewed by the Major Projects Assessment Agency described in Chapter 7.
28. Recommendation: Recognizing that potential suppliers to major projects have to be assessed on a firm-by-firm basis in order to determine the contribution they will make to the maximization of Canadian industrial and regional benefits, major project participants, both in the public and private sectors, should give preference in their procurement policies to suppliers of goods and services (including project management, engineering, procurement and construction services) in the following order of priority: 1) Canadian-owned firms; 2) Canadian-based firms; 3) others.
29. Business Recommendation: Major project participants, both in the public and private sectors, *should be encouraged to pay* premiums

totalling up to a maximum of 3 per cent of total project cost for the development of and purchases from generally competitive Canadian-based suppliers. Premiums should be allotted among Canadian-based firms in cases where it will contribute to the creation of new long-term industrial capability in Canada that can operate on a generally competitive basis. A discussion of some of the long-term benefits to Canada from the payment of such premiums is contained in Appendix D.

Labour Recommendation: Major project participants, both in the public and private sectors, *should pay* premiums totalling up to a maximum of 3 per cent of total project cost for the development of and purchases from generally competitive Canadian-based suppliers. Premiums should be allotted among Canadian-based firms in cases where it will contribute to the creation of new long-term industrial capability in Canada that can operate on a generally competitive basis. A discussion of some of the long-term benefits to Canada from the payment of such premiums is contained in Appendix D.

30. Recommendation: In cases where a Canadian-based firm that is a potential supplier can be made competitive in terms of price and long-term, capability with the technical assistance of an owner/sponsor, the owner/sponsor should make every reasonable effort to provide the assistance required.

Standardization of Requirements

Many of the industrial products required by major projects are highly specialized and the requirements from a single major project may be too small to allow efficient production in Canada. This problem may be compounded by design standards which are unnecessarily diverse.

31. Recommendation: In both the public and private sectors, project owner/sponsors and MEPC firms should, so far as possible, utilize design standards which provide the maximum opportunity for Canadian suppliers to compete effectively.

Work Packaging

It is often the case that the timing of demands, the large volume and/or the complex scope of work demanded in single orders preclude otherwise competitive Canadian-owned and other Canadian-based firms from supplying goods and services (including project management, engineering, procurement and construction services) to major projects.

32. Recommendation: Major project participants, both in the public and private sectors, should make every effort to facilitate the participation of Canadian-owned suppliers of goods and services (including project management, engineering, procurement and construction services) in major projects. Where no Canadian-owned firm is capable of undertaking all of the work associated with a particular aspect of a major project, work should be packaged in terms of size, scope and timing in a way that allows the maximum participation by Canadian-owned firms and, as a second priority, by other Canadian-based firms. Major project participants should encourage the participation of these firms in a manner that provides them with the experience base necessary to meet more extensive portions of major project demands in the future.

Aggregation of Supply Capability

The participation of Canadian-based suppliers of goods and services (including project management, engineering, procurement and construction services) in major projects is often limited by the inability of small suppliers to bid on very large orders. As a result, orders may go to large foreign suppliers even though the combined capacity of several smaller Canadian-based firms would have been adequate to competitively meet the demands.

33. Recommendation: Canadian-based suppliers of goods and services (including project management, engineering, procurement and construction services) should form joint ventures or consortia, merge or take whatever other steps are necessary in order to take advantage of major project opportunities.

Foreign Trade

Canadian industrial and regional benefits resulting from Canadian participation in international major projects can be substantially increased through input and involvement on the part of governments.

34. Recommendation: Governments should be prepared to offer assistance to Canadian-based suppliers of goods and services where this is necessary to compensate for advantages enjoyed by foreign competitors as a result of assistance from their governments.

35. Recommendation: Governments should assist in negotiating Canadian participation in foreign work connected with the acquisition of Canadian technology by other countries. In addition, offsets should be negotiated with respect to major Canadian import purchases in order to help maximize the utilization of Canadian industrial capability.

Industrial Structure

The ability of Canadian industry to supply major project requirements will be enhanced by the development of specific sectors of the economy. In this regard, Canada's current industrial structure is characterized by an insufficiently developed processing and secondary manufacturing sector which cannot fully capitalize on opportunities presented by projects related to natural resource upgrading. This is particularly true in manufacturing facilities established in Canada under the auspices of foreign-owned multinational enterprises, since Canadian operations frequently have corporate responsibility limited to serving the Canadian market. The Canadian small business sector has also not developed to the same extent as in other industrialized countries.

36. Recommendation: Government policies should ensure that business enterprises take advantage of downstream upgrading opportunities associated with natural resource projects in order to develop Canadian processing and secondary manufacturing capability.

37. Recommendation: Governments and industry should ensure that their procurement policies encourage the participation of small and medium-sized enterprises.

38. Recommendation: Governments should ensure that the Canadian operations of foreign-owned multinational enterprises are assigned the corporate responsibility of pursuing export trade opportunities. One approach to this is the designation of world product mandates for types of goods developed and manufactured in Canada.

Utilization of Developed MEPC Capability

In some cases, owner/sponsors of major projects choose to develop in-house project management, engineering, procurement and construction capability rather than utilize the services of a project MEPC contractor. To the extent that such MEPC capability is then not fully utilized on a continuing basis within the firm, a shortfall in Canadian industrial benefits can result if such capability is not marketed outside the firm.

39. Recommendation: Major project owner/sponsors who develop substantial in-house expertise should market any excess capability.

Finance

The volume of investment in major projects presents a major task in mobilizing funds and applying them in a manner that maximizes benefits to Canada. It is the Task Force's conclusion that capital availability per se will not be a difficult problem for the program of investment in major projects over the period to the year 2000. However, the sourcing and form that such funding takes are important factors in achieving maximum benefits from these projects.

40. Recommendation: As with other inputs into major project investments (such as machinery, equipment, labour, etc.), project owner/sponsors should first pursue Canadian sources in seeking out needed project financing.

41. Recommendation: Where foreign financing is utilized, projects should be encouraged to amortize such financing through the export of some of their production to avoid increasing the balance of payments deficit associated with debt servicing.

42. Recommendation: In terms of foreign sourcing of capital, preference should be given to foreign debt rather than equity, in view of the higher long-run cost of the latter particularly in relation to resource industries.

43. Labour Recommendation: Current tax measures with the avowed purpose of stimulating savings and investment should be reviewed with a view to transforming a large part of them in directions that would more clearly stimulate investment — e.g., to use the revenue now foregone to finance selective direct grant assistance to investment.

44. Labour Recommendation: In terms of the choice between direct grants versus tax expenditures, public policy should favour the former versus the latter in that grants are more visible and accountable. Moreover, in return for grant assistance, government should acquire an equity position.

45. Labour Recommendation: In exchange for special financing provisions, government should enter into "project agreements" with corporations which would make financial assistance conditional on performance in relation to the pursuit of Canadian benefits.

46. Labour Recommendation: The large oil and gas companies should be required to be more dependent on external financing rather than internal financing through the price mechanism. The main vehicle to achieve this would be a moderation of projected domestic energy prices which involve a regressive tax on consumers.

47. Business Recommendation: Where major projects are considered to be "in the national interest", government loan guarantees should be used where necessary to ensure the project actually proceeds. Where such guarantees actually result in an investment by government, then the project should provide a debt or equity instrument to government. If an investment by government is not required, there should be no cost to the project.

48. Business Recommendation: The government should implement measures that will stimulate increased Canadian investment in companies sponsoring the construction of major projects. One such measure would be the introduction of tax provisions similar to those of the Quebec Stock Savings Plan.

49. Business Recommendation: Continued high levels of government deficit spending can significantly affect the level of domestic capital available for investment in Canada. Governments must therefore be prepared to explicitly address the trade-offs between investment in services as opposed to major projects and manage their spending programs accordingly.

50. Business Recommendation: Current tax measures aimed at stimulating savings and investment (RRSPs, investment tax credits, accelerated depletion, etc.) should be continued to sustain high Canadian levels of savings and investment.

51. Business Recommendation: Direct investment by governments in major projects should not be accorded greater rights and privileges than any other investor.

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Appendix A

CIDC Task Force on the Decade Ahead: Organization, Procedures, and Participants

The Construction Industry Development Council (CIDC) was established in 1970. It is an advisory body appointed by the Minister of Regional Industrial Expansion to provide advice to him and, through him, to the Government of Canada concerning the medium- to long-term performance and well-being of the Canadian construction industry.

The CIDC membership comprises senior representatives of the industry's main sectors — construction management (contractors, builders, and developers), labour, the design professions of architecture and engineering, and manufacturers of industrial machinery and equipment and construction materials, equipment, and tools — plus government, education, finance, and research. The council's membership is also representative of the various regions of the country.

At the CIDC meeting in March 1981, approval was given to a proposal that a task force be appointed to study and submit recommendations on major issues and trends that would affect the Canadian construction industry during the decade ahead. Six principal subjects were selected, study groups formed, and their terms of reference agreed upon.

To obtain the benefit of special expertise, membership extended beyond that of the CIDC in many instances.

Progress reports were made at each subsequent council meeting and draft texts distributed to all council members for comment. Guidance was also obtained from additional experienced industry practitioners on specific topics. Summary chapters and recommendations were approved in principle by the council as a whole at its meeting in July 1983 and in final form in November 1983.

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Appendix B

Construction Industry Sectors and their Principal Business Associations*

Exploration and Development Firms
- Canadian Association of Oilwell Drilling Contractors
- Canadian Diamond Drilling Association

Process Purveyors
- Canadian Chemical Producers Association
- Canadian Copper and Brass Development Association
- Canadian Electrical Association
- Canadian Gas Association
- Canadian Nuclear Association
- Canadian Petroleum Association
- Canadian Pulp and Paper Association
- Coal Association of Canada
- Mining Association of Canada

Design Professionals
- Royal Architectural Institute of Canada
- Association of Canadian Industrial Designers
- Association of Consulting Engineers of Canada
- Canadian Institute of Planners
- Canadian Testing Association

Machinery Designers, Manufacturers and Suppliers
- Canadian Association of Equipment Distributors
- Canadian Boiler Institute
- Electrical and Electronic Manufacturers Association of Canada
- Machinery and Equipment Manufacturers Association of Canada

Construction Material and Component Manufacturers and Suppliers
- Architectural Aluminum Association of Canada
- Architectural Woodwork Manufacturers Association of Canada
- Canadian Construction Association — Manufacturers' & Suppliers' Section
- Canadian Electrical Distributors Association
- Canadian Home Builders' Association — Manufacturers' Council
- Canadian Institute of Plumbing and Heating
- Canadian Institute of Treated Wood
- Canadian Lumbermen's Association
- Canadian Manufactured Housing Institute
- Canadian Manufacturers' Association
- Canadian Paint Manufacturers' Association
- Canadian Portland Cement Association
- Canadian Sheet Steel Building Institute
- Canadian Solar Industries Association
- Canadian Wood Council
- Clay Brick Association of Canada
- Corrugated Steel Pipe Institute
- Heating, Refrigeration and Air Conditioning Institute of Canada
- Insulated Glass Manufacturers' Association of Canada
- National Concrete Producers Association
- Society of Plastics Industry of Canada
- The Waferboard Association

General Contractors
- Canadian Construction Association — General Contractors' Section

Specialty Civil Contractors
- Canadian Construction Association — Road Builders' & Heavy Construction Section
- Pipe Line Contractors Association of Canada

EPC Contractors
- Canadian Construction Association — Industrial Contractors' Section
- Industrial Contractors Association of Canada

Trade Contractors
- Canadian Automatic Sprinkler Association
- Canadian Construction Association — Trade Contractors' Section
- Canadian Electrical Contractors Association
- Canadian Institute of Steel Construction
- Canadian Masonry Contractors Association
- Canadian Painting Contractors Association
- Canadian Prestressed Concrete Institute
- Canadian Roofing Contractors Association
- Mechanical Contractors Association of Canada
- National Elevator & Escalator Association
- Reinforcing Steel Institute of Canada
- Sheet Metal & Air Conditioning Contractors' National Association
- Terrazzo, Tile & Marble Association of Canada
- Thermal Insulation Association of Canada

Construction Management and Project Management Firms
- Canadian Chapters, American Association of Cost Engineers
- Project Management Institute

Developers
- Building Owners and Managers Association of Canada
- Canadian Home Builders' Association
- Canadian Institute of Public Real Estate Companies
- Real Estate Institute of Canada
- Urban Development Institute of Canada

Residential Builders
- Canadian Home Builders' Association (formerly the Housing and Urban Development Association of Canada)

RRR Contractors
- Canadian Home Builders' Association — Renovators' Committee

Multi-Sector Associations
- Canadian Construction Association
- Canadian Home Builders' Association
- Canadian Section, Conseil international du bâtiment
- Canadian Standards Association
- Canadian Technical Asphalt Association
- Community Planning Association of Canada
- Construction Specifications Canada
- Roads and Transportation Association of Canada
- Tunnelling Association of Canada

*NOTE: Many in this list of Canada-wide organizations have chapters. In addition, many sub-sectors of the industry have provincial, regional or local associations but have not as yet organized on a national basis.

Construction Trades Labour

Canadian Executive Board for the Building & Construction Trades (AFL-CIO)
Canadian Federation of Labour
Canadian Labour Congress
International Association of Bridge, Structural and Ornamental Iron Workers
International Association of Heat and Frost Insulators and Asbestos Workers
International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers
International Brotherhood of Electrical Workers
International Brotherhood of Painters and Allied Trades
International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America
International Union of Bricklayers and Allied Craftsmen
International Union of Elevator Constructors
International Union of Operating Engineers
Labourers' International Union of North America
Operative Plasterers' and Cement Masons' International Association of the United States and Canada
Sheet Metal Workers' International Association
United Association of Journeymen & Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada
United Brotherhood of Carpenters and Joiners of America

Appendix C

Criteria to consider in decision-making for the acquisition of design and of construction services

The bulk of the new construction program is contracted-out and there has been a noteworthy trend towards the contract system for maintenance and repair work.

Some owners, however, maintain their own staffs to perform architectural and engineering design, project/construction management and construction functions. Others may consider doing so from time to time.

It is recommended that senior management establish a policy for their organization subscribing to contracting-out as a basic principle and normal procedure and requiring that criteria such as the following be considered before exceptions are authorized — i.e. to have work done in-house:

1. Is the execution of design and/or construction services in-house compatible with the basic purpose of the organization?
2. Is the nature of the work such that the competitive functions of the market-place are not desired?
3. Is the volume of the work sufficient to require continuing full-time employment of the people involved and a commitment by the organization for an increase in overhead expenses?
4. Are the construction projects varied as to nature, location and size so that the selection of different designers and contractors because of their particular expertise is desirable?
5. Are cost comparisons between contracting-out and in-house work placed on a "true total cost" basis? i.e. is due allowance made in calculating in-house costs to office and warehouse space, capital outlays, depreciation of equipment, "fringe benefit" costs including liability for pension payments, support costs, start-up, learning and one-time costs, inventory and other overhead expenses, etc.?
6. If a sizeable in-house operation is contemplated, is the organization prepared to assume the costs of training, refresher and professional advancement courses?
7. Have adequate efforts been made to obtain design and/or construction services from the architectural and engineering professions and the construction industry?
8. Would there be recourses available to the organization in the event of failure-to-perform by in-house personnel comparable to those related to professional liability insurance, surety bonds and contract provisions carried, provided or agreed to by professional design firms and construction companies?
9. Would in-house design and construction personnel be motivated to the same degree as those in the market-place in terms of the desire to establish a professional or business reputation, the stimulation of a wide variety of assignments, and the desire to improve efficiency because of the compelling constraints of established fees and firm prices?

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